From: Aaron Nissen
To: Bill Morgan; Jerry Finlinson; Ken Nielson
CC: Garry Christensen
Date: 12/17/2002 3:36 PM
Subject: OFA system control logic

just a thought...

I assume minimum air flow requirements, for pulv light off and unit startup, would have to be modified to include minimum air flow minus the overfire air requirements (assuming the 1/3 damper position), since the OFA is being diverted from secondary air required for the flame/ fire ball.

From: Ken Nielson
To: fpalacios@bbpwr.com
CC: Bill Morgan; James Nelson; Jerry Finlinson
Date: 12/30/2002 9:27 AM
Subject: Intermountain Power. Contract 100210 - Overfire air system controls

Francisco:
As I have been out of the office for a good share of the last several days, I am just checking in to see how things are progressing with the OFA controls design.

We will need to put our construction package together as soon as possible to meet our scheduling requirements. Accordingly, when do you estimate that the controls design will be completed for our review? Your e-mail of 12/11/02 summarized very well our discussions on the general hardware design. Have you encountered any problems or concerns since then with concepts we discussed? Also, Bill Morgan sent, and we presume that you have received, the SAMA diagrams of our existing secondary air controls. Do you have any concerns with the software changes we will need to implement for the OFA control? We would like to see the proposed software changes as soon as is possible.

Thank you for your efforts.

It is my hope that your holiday season has been enjoyable and wish you all the best of the New Year!
Sincerely,

Ken Nielson

Kenneth M. Nielson, P.E.
Lead Engineer, Technical Services
Intermountain Power
Delta, UT 84624
(435) 864-6437
kenneth-n@ipsc.com

From: <fpalacios@bbpwr.com>
To: <KENNETH-N@ipsc.com>
CC: <BILL-M@ipsc.com>, <Jerry-F@ipsc.com>, <JIM-N@ipsc.com>, <ddorman@bbpwr....
Date: 1/2/2003 6:53 AM
Subject: Re: Intermountain Power. Contract 100210 - Overfire air systemcontrols
Attachments: OFA Control Description.doc

Ken:

I tried to send this e-mail several times on Tuesday. I think your server was probably down or communications could not be established. Here I try again

Thank you for your e-mail of 12/30/2002. For the last couple of weeks we have been busy finalizing the mechanical design and the control philosophy. There are some modifications to my initial understanding of the control strategy after in depth discussions with our process people. Basically, the main difference is that we will not be using the "feeder duct" dampers other than for balancing purposes. The attached control description and basic SAMA explains our thinking. Please review and comment. Also please let me know if this description is sufficient for you to develop the control. Otherwise let me know if you need anything else.
Thank you for your SAMAs. They were a big help in understanding the present controls.

I also hope you had great holidays and wish you a happy new year.

Francisco

(See attached file: OFA Control Description.doc)

Babcock Power, Inc.
Worcester, MA

Control of Overfire Air
For
Intermountain Power - Unit 2
850 West Brush Wellman Road
Delta, Utah

Babcock Power Inc. Contract 100210

December 30, 2002

Description if the Overfire Air (OFA) System and Control Devices.

The overfire air system consists of new rows of OFA ports located above the top burner elevation, front and rear of the boiler. There are two sets of ports with a relative area split of 1/3 and 2/3. The 1/3 ports over the 2/3 ports, and both located directly above each of the six burner columns. Similar sets of two ports, the "wing ports", are located beyond the burner columns, close to the side walls of the boiler, for a total of 8, 1/3 ports and 8, 2/3 ports on the front and the same on the rear side of the boiler.

Sets of four, either 1/3 or 2/3 port dampers, are connected together (ganged) by means of linkages so that the four port dampers of the same kind are operated simultaneously by means of a single Jordan rotary electrical damper operator. There are then a total of four damper drives on the front and four on the rear of the boiler.

The linkages as well as the ducts that form the 1/3 and the 2/3 ports are all internally located in OFA crossover ducts, front and rear. The crossover ducts are fed by four OFA feeder ducts connected to the air plenums that convey secondary air to the burner elevations on the left and right sides of the unit.

The damper drives that operate the 1/3 damper trains are Jordan SM-5120 series, powered by single phase, 120 VAC and furnished with remotely located servo-amplifiers capable of receiving 4-20 mA demand signals and providing 4-20 mA position signals for the Purchaser's use.

The damper drives that operate the 2/3 damper trains are higher torque Jordan SM-5220 series with the same characteristics as the 1/3 port damper drives.

Each of the OFA "feeder" ducts at each corner of the unit is provided with manually operated balancing dampers. There is also an Air Monitor Corporation array of three VOLU-probes and thermocouples to measure OFA mass flow on each of the feeder ducts. Each array is provided with a CAMM "Smart" mass flow

transmitter and "Combustion Air Management System" (CAMS) to provide automatic compressed air purge to the VOLU-probes.

Description of the Proposed Control Strategy.

Note: All boiler load setpoint values and OFA to secondary air ratio setpoint curve, described below, are initial values. These values will be revised based on the results of the commissioning performance tests. Please refer to documentation to be provided by BPI.

Overfire air is used to control NOx formation and is generally required at higher boiler loads (above 60%). OFA flow is accomplished by the combination of two actions.

Firstly, by the programmed opening of the OFA ports of one kind or the other in the pattern described below in this description. The OFA port dampers are not modulating and are to be operated either fully open or fully closed (except for biasing of the open position to achieve balance O2 or NOx distribution on the back end of the boiler).

Secondly, by forcing secondary airflow to the OFA system. This is attained by simultaneously and identically decreasing the opening of all the combustion air dampers feeding each of the burner elevations. This decrease is to be superimposed on the existing automatic control biasing of each elevation combustion air in accordance with its pulverizer load.

Because of the very low available air pressure in the secondary air plenums feeding both the OFA ports and the burners, it is anticipated that the dampers located in the OFA feeder ducts will not be effective for modulation control (fully open they will not be able to establish the required OFA flow). These dampers are to be used only for the local, manual side to side balance of the OFA crossover ducts. After initial commissioning these dampers will be locked in place.

Mechanical interference in the crowded OFA areas and limited space make it impossible to ideally locate the air flow monitors upstream of the balancing dampers. These monitors will be mounted in short straight runs of duct downstream of these dampers. However, these dampers will be permanently open (except for the slight bias required for balancing) and, in addition, they are of the opposed blade design. These design conditions will minimize flow pattern disturbance. Furthermore, it should be pointed out that very accurate OFA flow measurement is not necessary to attain effective OFA control.

Automatic and simultaneous biasing of all the secondary air modulating dampers at each burner elevation, so that they attain a closer position than at present, will be used to divert air to the OFA system.

The above effect will be accomplished by a new control loop, provided, designed in detail and implemented by the Purchaser in its combustion control system. This control loop will have, as process variable; the ratio of the total measured OFA flows to the existing measured total secondary air; and as the setpoint,

the desired ratio of these two air flows. This ratio is not constant and is derived by BPI as a function of total boiler load.

This secondary air damper control is additive to the existing bias required to change burner airflow in proportion to the individual pulverizer load. The action of the sum of both biases will result in less secondary air directly to the burners, as OFA is being introduced, but the relative secondary air distribution between burner elevations will remain unchanged.

Note: BPI will provide a setpoint curve showing the desired ratio of OFA flow to secondary airflow as a function of boiler load. These values will be confirmed or revised by actual tests.

Note: There shall be agreement between this setpoint curve and the actual airflow measurements: i.e. it shall be decided by the purchaser and BPI if the ratio is based on OFA to secondary air only or OFA to total combustion air, which includes primary air, based on current measurement availability.

The operator can also select a constant setpoint for commissioning or test purposes. Either setpoint is limited to the expected maximum range of OFA to total airflow ratio (i.e. 0 to 20%).

Figure 1 describes this control loop in general terms.

The OFA port relative open area sizes, 1/3 and 2/3, are calculated to provide the correct velocity of the OFA to attain the proper penetration of the OFA into the combustion region of the furnace above the burners. For this reason it is not recommended to modulate the OFA port dampers since changes in the damper position will affect the penetration velocity. All ports of a given kind: 1/3 or 2/3, will open or close following a program designed to open the correct area to roughly produce the proper penetration velocity as the OFA air flow rate changes with boiler load. The initial program is as follows:

0 to 60% boiler load:	All 1/3 and 2/3 ports closed
60 to 75% boiler load:	1/3 ports open, 2/3 ports closed
75 to 90% boiler load:	1/3 ports closed, 2/3 ports open
90 to 100% boiler load:	1/3 ports open, 2/3 ports open

An individual manual/automatic and bias station per port group damper drive is recommended.

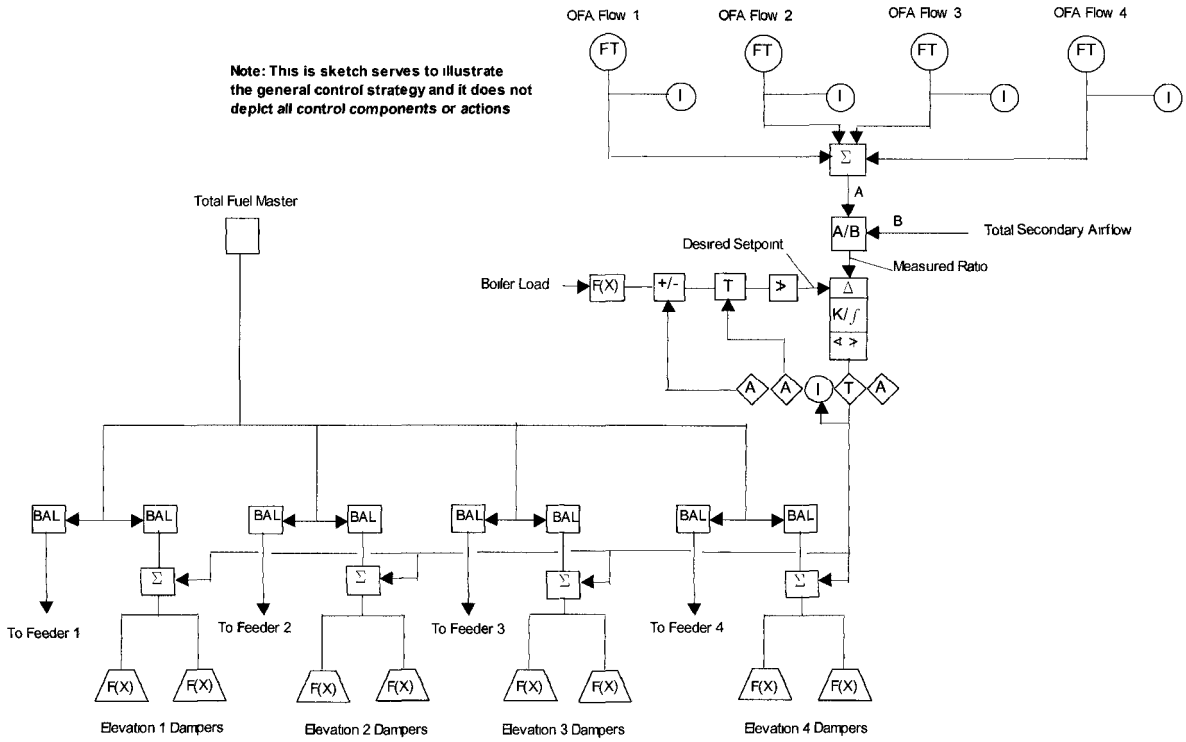
Note: This is sketch serves to illustrate the general control strategy and it does not depict all control components or actions
OFA Flow 1
OFA Flow 2
OFA Flow 3
OFA Flow 4
FT
I
Σ
A
B
A/B
Total Secondary Airflow
Measured Ratio
Desired Setpoint
Boiler Load
F(X)
+/-
T
Δ
K/∫
Total Fuel Master
BAL
To Feeder 1
To Feeder 2
To Feeder 3
To Feeder 4
Elevation 1 Dampers
Elevation 2 Dampers
Elevation 3 Dampers
Elevation 4 Dampers

Fig 1

From: <fpalacios@bbpwr.com>
To: <KENNETH-N@ipsc.com>
CC: <BILL-M@ipsc.com>, <Jerry-F@ipsc.com>, <JIM-N@ipsc.com>, <ddorman@bbpwr....
Date: 1/3/2003 12:15 PM
Subject: Re: Intermountain Power. Contract 100210 - Overfire air systemcontrols
Attachments: OFA Control Description Rev1.doc

Ken:

According to your call of today, I have talked to Larry Boucher and to the mechanical design group and we are in agreement to keep the balancing dampers to be operated remotely by Jordan electrical damper drives as per original supply. Again we recommend that these dampers be used to balance the ducts and left in the "as balanced" position and be returned to that position after any other movement that you may occasionally subject them to, as during emergencies, etc.
Please find attached Revision 1 of the "Control of Overfire Air" document, which revises the operation of these dampers from local manual to remote electrical.

(See attached file: OFA Control Description Rev1.doc)

From: Aaron Nissen
To: Jerry Finlinson
CC: Bill Morgan; Garry Christensen; Ken Nielson
Date: 3/27/2003 6:00 PM
Subject: Fwd: RE: Air Monitor traverse test plans

Jerry

Overfire Air Ports
Like we discussed, we need to conduct full profiles at all four locations. If the profiles are uniform, we can cut back on the number of traverse points. However, all four locations are configured somewhat differently. So you may be able to cut back on some locations more than others, but the data needs to be graphed out to really see what you have.

Primary Air Ports
Here the configuration on ports is fairly uniform for all. I would still suggest conducting full profiles and graphing results to see how much it is feasble to cut back. It'd be conservative on how much you cut back, you get what you pay for. What's the point on conducting all the calibrations if you cutting way back on the number of traverses (trying to make it more convenient and less time consuming for the tester).

>>> Jerry Finlinson 03/27/03 12:56PM >>>
Garry and Aaron,
What do you think of Dan's proposal about not doing all the PA traverse ports?
Later, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Dan Beistel <dbeistel@airmonitor.com> 03/27/03 06:56AM >>>
Jerry,

I hope we can do all you want next week it will be tough. also I don't think we need to all 9 ports. The venture effect will flatten the profile out. We can do 9 ports on the first one and see how it looks, if it is flat we can due less ports on the others.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Wednesday, March 26, 2003 8:10 PM
To: dbeistel@airmonitor.com
Cc: Aaron Nissen; Bill Morgan; Garry Christensen; Ken Nielson
Subject: RE: Air Monitor traverse test plans

Dan,
Thanks for your home contact info.
We have received your traverse probes in receiving.

Our performance guys really want to get all the flow calibrations done next week, because they are doing some major performance upgrades and don't want erroneous flows to influence the results.
We have 8 pulverizers, but one of them is out of service, so hopefully we can traverse all 7 operating pulverizers and the 4 CAMS systems up on the overfire air during the week.

Our plan is to test 3 or 4 on Monday, the remaining on Tues, then move up and do the 4 overfire air Wednesday.
We'll work long days if necessary.

On the PA ducts into the pulverizers, there are 9 traverse ports and we hope to do them at 3 loads.
Possibly if the first 2 or 3 look very good, then we might be able to do less ports.

Is it reasonable to test 9 ports at 3 loads in about 3 hours?
How long does it take to traverse a port?
Do you get a signal the entire length? or do you simple do top, bottom, middle?
We are interested to see your equipment and set up.

I'll let you know on Thursday if we have any trouble with our CAMS signals or setup.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Dan Beistel <dbeistel@airmonitor.com> 03/26/03 10:32AM >>>
Jerry if a major problem comes up between Thur. to Sun. call me at home at
919-779-7225. after 5pm or 919-844-3100 ext. 18 before 5pm

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Wednesday, March 26, 2003 12:14 PM
To: dbeistel@airmonitor.com
Subject: RE: shipping FEDEX noon to 2pm

I just called receiving and they said that the morning FedX comes at 10am and the
afternoon one comes between noon and 2pm. So for guaranteed shipping, we'd have to
have it down to shipping at noon Thursday.

We are still working on getting all the thermocouples connected.
We don't really like the terminals in the thermocouple heads.
The wires are so small that they have put a copper sleeve around the wires,
then it goes through a brass block.

So there is potential for long term corrosion problems with those copper sleeves.
Do you have any other options?
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Dan Beistel <dbeistel@airmonitor.com> 03/26/03 07:31AM >>>
I may need to ship on Thur. afternoon if possible. I will come buy Sun.
to
unload the equipment. We can get started Mon. morning. If everything is
going good with the boiler we should be able to do the mills next week or
the overfire air. I can come back later and finish the other set of ducts.

Can you find out what the exact time is.

Sorry for the inconvenience.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Tuesday, March 25, 2003 8:13 PM
To: dbeistel@airmonitor.com
Subject: RE: Change date of trip to IPP to start March 31st in Delta UT

Are you saying that Friday April 4th you need to ship it to another site?
I think UPS and Fedex ship at 10am, but I can find out the exact time.
Maybe we could get set up on Sunday afternoon and get started a little
quicker?
Later, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Dan Beistel <dbeistel@airmonitor.com> 03/25/03 11:33AM >>>
Jerry,

I need to ship the traverse equipment out next day air. When does UPS or

Fed-x come to the plant for pick up? We are going to be on a tight schedule,
we may need to do this in 2 trips, your thoughts.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, March 20, 2003 7:26 PM
To: dbeistel@airmonitor.com
Subject: Change date of trip to IPP to start March 31st in Delta UT

Dan,
We had a big discussion of our startup testing today.
The consensus was that you should come out on Sunday the 30th and we could start into the testing on March 31st Monday. STay one week.
Does that work OK for you.

We think we can go out ahead of time and test the CAMS panels. We could put in some calibration air pressure and make sure that they are outputting a reasonable air flow measurement value. We'll start that and let you know if we have any problems.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Jim Knapp
To: Jerry Finlinson; Ken Nielson
Date: 10/1/2003 2:28 PM
Subject: AIR FILTERS

Jerry had me order the air filters to the CAMS units for the Primary Air to the Pulverizers, today. He suggested I order the filters for the Over Fire Air project at the same time. There are 12 on order now, 8 for the PA flow and 4 for the OA project. If this is not going to be enough, or you would like to do it differently, just let me know.

Thank you.

From: Kevin Miller
To: Jerry Finlinson
Date: 11/4/2003 8:58 AM
Subject: Re: OFA project sootblower cabs

It's already handled. We plan to do this between Thanksgiving & Christmas when the boiler is at its coolest for comfortable working. Gary Sperry is going to do it.

Thanks, Kevin

>>> Jerry Finlinson 11/3/2003 9:32:32 AM >>>
Kevin,
The overfire air project will need to have the sootblower control cabinets moved out of the way on the 9th floor, similar to what was done last year on U1. What details or direction do we need to schedule that work?
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Ken Nielson
To: Aaron Nissen; Bill Morgan; Garry Christensen; James Nelson; Jerry Fi...
Date: 12/1/2003 7:02 PM
Subject: U1 Outage Report on OFA Work

FYI:
Summary of the U1 OFA work completed by IPSC Maintenance and Rocky Mountain personnel under the direction of Phil Hailes and Ken Nielson during the 11/26/03 mini-outage. Photos showing the problems listed below are found in the following directory - **N:\Current\Projects\IGS02\IGS02-14 Boiler Modifications - JHN\6.Documentation\U1 Mini-outage Photos-Control Linkage & bearings**.

Problem Found: Broken Weld - on the NW 1/3 damper linkage, through-wall shaft, external drive-arm to shaft weld.
Action taken: 3 welds placed on inside and outside of the drive arm using 309 SS rod. (Note: The drive-arm to shaft weld in the same location on the NE 1/3 damper linkage was reinforced with the same method even though that weld was not broken. During the June outage, all other drive-arm to through-wall shaft welds were similarly reinforced.

Problem Found: Bent linkage - on the SW 1/3 damper linkage, the connecting link between the motor drive arm and the external drive-arm on the through-wall shaft would bend when the motor drive was driven to 100%. It was also observed that with the motor drive at 0%, actual damper position was approx. 25% open. Bending appeared to be caused by over-stroking of the motor drive-arm due to an error in the positioning of the drive-arm on the splined shaft of the motor drive.
Action Taken: Bent linkage repaired and the drive arm was correctly positioned on the motor drive splined shaft. This corrected both the over stroking and subsequent linkage pressure at the 100% position and the damper position error at the 0% position.

Problem Found: Failed linkage bearings - all OFA bearings internal to the OFA duct were found to have failed. This includes bearings on the through-wall shaft, distribution shaft, and individual damper shafts. Problem was due bearing service ratings being 700 degF with operational temperatures at 700 degF, bending and flexure pressure on linkage related to linkage design, and wear from ash in duct air.
Action Taken: All bearings on the distribution shafts were replaced with graphite based journals rated to 1000 degF. Outage time constraints did not permit replacement of the bearings on the through-wall shafts or the individual damper shafts. Wear plates were installed on all through wall shafts during the June mini-outage for shaft protection until a planned outage will permit replacement. Replacement of remaining bearings and inspection of replaced bearings recommended for next major outage.

Problem Found: SE 2/3 shaft in flexure with damper at 100% position - see photo. Flexure caused by improper position of through-wall shaft internal drive arm. No action take due to outage time constraints. Correction recommended during next major outage.

Problem Found: Significant bending moment pressure observed on all through-wall shafts during damper actuation. No action taken as issue is related to linkage design and outage time constraints prevented implementation of possible solutions. Further evaluation of this problem recommended.

Additional recommendations: Inspection of OFA linkage recommended at next outage with fireside clearance.

From: Ken Nielson
To: Jerry Finlinson
Date: 2/29/2004 11:54 PM
Subject: Re: OFA duct CAMS probe lengths.

The duct dimensions should be the same as last year. The CAMS probes should be identical for the duct inlets.

The ports are the same at the boiler wall; but, instead of turning down, they turn toward the inlet ends of the duct. As a result, the dimensions of the inlet to the ports are about half size. That should not affect the probe length of the volu-probes in the ports.

But, I will take some measurements. Thanks for the heads-up.
Ken

>>> Jerry Finlinson 2/29/2004 8:48:34 PM >>>
Ken,
I was out walking down a clearance and I noticed that the west OFA ducts seem short.
Did they change the duct design from last year?
We need to verify that the CAMS probes are the correct length.
They may need adjusting if Babcock has changed the design.
Later, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
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435-864-6466 fax 0776/6670
jerry-f@ipsc.com

Jerry Finlinson - AMC work at Intermountain

From: Chuck Cummins <ccummins@airmonitor.com>
To: "'Jerry-f@ipsc.com'" <Jerry-f@ipsc.com>
Date: 4/27/2004 1:49 PM
Subject: AMC work at Intermountain

Hi Jerry,

Dan Beistel can return to Intermountain to finish up work on Monday, May 10. We hope that this is OK.

As I understand it, a 14 foot traverse probe was left at the jobsite so we need to bring in the traverse panel and accessories. Is that correct? Please let me know. Regards,

Chuck Cummins
Service Engineer
Air Monitor Corporation
1-800-AIR-FLOW (1-800-247-3569) EXT. 742
ccummins@airmonitor.com
http://www.airmonitor.com

From: Dan Beistel <dbeistel@airmonitor.com>
To: Jerry Finlinson <Jerry-F@ipsc.com>
Date: 5/6/2004 10:00 AM
Subject: RE: OFA calibration at Intermountain Power.

Steve is coming on Tues. He can help me on Tues. I'll see if he can come on WED. instead or both days.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, May 06, 2004 10:23 AM
To: dbeistel@airmonitor.com; hossman@bellsouth.net
Subject: OFA calibration at Intermountain Power.

Dan,
We are anxiously awaiting your arrival to do air flow calibrations of the OFA pitots next week.

My wife is leaving town to visit her sister Wednesday, so I'm on the hook for babysitting Wed thru Sat next week.

It would be nice if we could get started on Monday afternoon, do most of the tests Tuesday and Finish up Wednesday.
If necessary I'll find an I&C Tech to work with you on Wednesday, or I might find a baby sitting to cover for me part of the day.
For sure we'd like to get the K-Factors entered into the OFA CAMMS.

Hope you have a good trip.

see you next week.
Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

Jerry Finlinson - after Intermountain traverse

From: Chuck Cummins <ccummins@airmonitor.com>
To: "'Jerry-f@ipsc.com'" <Jerry-f@ipsc.com>
Date: 5/10/2004 11:02 AM
Subject: after Intermountain traverse
CC: Dan Beistel <dbeistel@airmonitor.com>

Hi Jerry,

This is to confirm our conversatiion regarding the AMC traverse equipment at the conclusion of this week's work. I would like to have the traverse panel and accessories shipped UPS Red (AMC acct. number 952265) to:

Graphic Packaging International
1000 Jonesboro Road
West Monroe, LA 71292

The plant contact there is Bill King at 318-362-2288. If I could get tracking numbers for this shipment, it would be great.

The 14 foot traverse probe should be shipped via Yellow Freight to our facility in Santa Rosa, CA. I will FAX the Bill of Lading to you at 435-864-0776.

Thanks for your help,

Chuck Cummins
Service Engineer
Air Monitor Corporation
1-800-AIR-FLOW (1-800-247-3569) EXT. 742
ccummins@airmonitor.com
http://www.airmonitor.com

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DATE 5/12/04

SHIPPER (ORIGIN)			
FROM SHIPPER	INTERMOUNTAIN POWER SERVICES		
STREET	850 WEST BRUSH WELLMAN RD.	SHIPPER'S NUMBER	SERVICE DEPT
CITY, STATE, ZIP	DELTA, UT 84624	CUSTOMER P O NO	
CONSIGNEE (DESTINATION)		**BILL TO (MAILING ADDRESS)**	
TO CONSIGNEE	AIRMONITOR	BILL TO NAME	AIRMONITOR CORP
STREET	1050 HOPPER AVE	ADDRESS	1050 HOPPER AVE
CITY, STATE, ZIP	SANTA ROSA, CA 95403	CITY, STATE, ZIP	SANTA ROSA, CA 95403

PIECES	HAZ MAT	KIND OF PACKAGING, DESCRIPTION OF ARTICLES, SPECIAL MARKS AND EXCEPTIONS (Subject to Correction) LIST HAZARDOUS MATERIALS FIRST	WEIGHT LBS. (Subject to Correction)
1		EQUALIZER EXCHANGERS, AIRMONITORING DEVICES	
		FAK CLASS MACHINERY ITEM 133300	
		3"x 3"x 15' (14 FOOT TRAVERSE PROBE)	67
TOTAL PCS.	MARK "X" IN COLUMN FOR HAZARDOUS MATERIALS	24 HR EMERGENCY RESPONSE HAZ MAT PH# ( )	TOTAL WT. 67

C.O.D.

C O D AMT. $

CUSTOMER'S CHECK ACCEPTABLE FOR C O D ? YES ☐ NO ☐

C O D FEE IS COLLECT UNLESS MARKED PREPAID ☐ C.O.D. FEE PREPAID

REMIT C.O.D TO NAME

ADDRESS

CITY, STATE, ZIP

FREIGHT CHARGES

PREPAID UNLESS BOX IS CHECKED

COLLECT IF BOX IS CHECKED ☒

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The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

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RECEIVED subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and shipper, if applicable, otherwise to the rates, classifications and rules that have been established by the carrier and are available to the shipper on request. The property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked consigned, and destined as shown above which said carrier agrees to carry to destination, if on its route, or otherwise deliver to another carrier on the route to destination. Every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of the shipment. Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

This is to certify that the above named materials are properly classified, described packaged marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation

SHIPPER	CARRIER YELLOW TRANSPORTATION
PER	DRIVER PCS DATE
COLLECTED AT PICKUP $ ☐ CASH ☐ CHECK ☐ C/CARD TYPE	

ATTN: JERRY FINLINSON

From: Aaron Nissen
To: Jerry Finlinson
CC: Bill Morgan; Garry Christensen; Howard Scott; James Nelson; Jerry Hi...
Date: 5/21/2004 12:56 PM
Subject: U2 (& U1) OFA CAMS reading o/s

Jerry-F

We need some help!! We have a hard time believing the out of service air flow reading thru overfire air system (CAMS). It's reading 8.5 to 9% (of the total boiler air flow is leaking thru the shutoff dampers) and would expect maybe 2 to 3% (although U1 readings have also always seemed high at 4%, but aren't near as high as U2)
with 1/3 dampers full open we would expect 9%
with 2/3 dampers 12 to 14% (depending if you balance north and south sides)
with both 1/3 & 2/3 dampers ~15%

We think there's a problem with the CAMS setup. Garry suggested that maybe the purge air flow is too great at the "no flow" condition causing us a bogus reading. Can we try shutting down purge air and testing to see if flow drops off? Can we keep purge air off if inlet dampers are closed? Is setup correct? Might want to talk to Air Monitor to check, but something is seriously wrong!!

This impacts NOX Environmental Monitoring and reporting to the State. We have to discount OFA operation and prove that it is off and out of service. Right now on U2 we have to drop our allowable NOx emissions target (can't receive credit for OFA operation), because OFA is above 4.0%, we lower emissions target 10%, even though OFA is out of service.

Any other ideas? Any help or support from the rest of you would be appreciated!!

Jerry Finlinson - Re: Fwd: U2 (& U1) OFA CAMS reading o/s (FWD)

From: Ken Nielson <knielson55@yahoo.com>
To: <Aaron-N@ipsc.com>, <garry-c@ipsc.com>
Date: 5/21/2004 9:55 PM
Subject: Re: Fwd: U2 (& U1) OFA CAMS reading o/s (FWD)
CC: <Bill-M@ipsc.com>, <jerry-F@ipsc.com>, <jon-c@ipsc.com>

Aaron,
You may have already resolved the OFA air flow issue with Jerry. If not, I will be back Monday and we can continue to investigate. However, in the mean time, a couple of items to keep in mind:

A) The CAMS purge air is not a continuous operation. It occurs once an hour for one minute and is completely shut off after that. It is possible that an SVs may stick, but very unlikely that the SVs in all the CAMS would be sticking. So, I am quite sure this is not part of the problem.

B) Because of the very low dP over the CAMS volu-probes, both Air Monitor and Babcock-Borsig/Riley-Babcock indicated from the start that accuracy and precision would be difficult. As such, they also indicated that following tuning of the CAMS panels the highest accuracy and precision would be achieved at full flow conditions. At no or very low flow conditions, accuracy would suffer and readings would be more a gross indication of no/low flow. However, the CAMS was the best option available and still is.

C) Having said all that, 8% is a significant error and would indicate either a problem with the configuration of the CAMS units or unexpected leakage. As I recall Unit 2 SA runs at higher pressure than Unit 1, we should investigate whether the pressure difference is proportional to the difference in reading between Unit 1 and Unit 2.
-Ken N.

Ken Nielson <KENNETH-N@ipsc.com> wrote:

> ATTACHMENT part TEXT message/rfc822
Date: Fri, 21 May 2004 12:56:12 -0600
From: "Aaron Nissen"
To: "Jerry Finlinson"
CC: "Bill Morgan" ,
"Garry Christensen" ,
"Howard Scott" ,
"Jerry Hintze" ,
"Jim Knapp" ,
"James Nelson" ,
"John Fritzges" ,
"Jon Christensen" ,
"Ken Nielson" ,
"Phil Hailes" ,
"Rand Crafts" ,
"Richard Schmit"

Subject: U2 (& U1) OFA CAMS reading o/s

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always seemed high at 4%, but aren't near as high as U2)
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Can we try shutting down purge air and testing to see if flow drops off? Can we keep
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to check, but something is seriously wrong!!

This impacts NOX Environmental Monitoring and reporting to the State. We have to
discount OFA operation and prove that it is off and out of service. Right now on U2
we have to drop our allowable NOx emissions target (can't receive credit for OFA
operation), because OFA is above 4.0%, we lower emissions target 10%, even though
OFA is out of service.

Any other ideas? Any help or support from the rest of you would be appreciated!!

From: Dan Beistel <dbeistel@airmonitor.com>
To: Jerry Finlinson <Jerry-F@ipsc.com>
Date: 5/24/2004 5:10 PM
Subject: RE: Intermountain U2 (& U1) OFA CAMS reading o/s

Is there that much leakage through the dampers?

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 10:45 AM
To: dbeistel@airmonitor.com; hossman@bellsouth.net
Cc: achew@airmonitor.com; mmaragos@airmonitor.com; Aaron Nissen; Bill Morgan; James Nelson; Jon Christensen; Ken Nielson
Subject: Fwd: Intermountain U2 (& U1) OFA CAMS reading o/s

Dan,
As you can see below our performance guys are having some major questions about the
overfire air flow in the dampers closed position. Unfortunately, when you were here, we didn't calibrate
the zero position. When you calibrated the 1/3 open , 2/3 dampersopen, and both open, the K-factor increased the zero flow significantly as well. Our overfire air permit requires them to shut off tighter than 5% total air, but right now in the shut off position we are getting about 8% total air or 60% OFA flow of 160,000 lb/hr. I guess we can take the K-factor out, but we might prefer to redo it with the zero flow point, then the 1/3 and 2/3. Is there any way to include a curve fit correction? I guess we could do that in the DCS.
Later, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Aaron Nissen 5/21/2004 12:56:12 PM >>>
Jerry-F

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thru overfire air system (CAMS). It's reading 8.5 to 9% (of the total boiler air flow is leaking
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operation), because OFA is above 4.0%, we lower emissions target 10%, even though
OFA is out of service.

Any other ideas? Any help or support from the rest of you would be appreciated!!

From: Dan Beistel <dbeistel@airmonitor.com>
To: Jerry Finlinson <Jerry-F@ipsc.com>
Date: 5/24/2004 5:12 PM
Subject: RE: Intermountain OFA Factor questions

Paresh,

I think the bias may be causing the error.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 6:25 PM
To: pdave@airmonitor.com
Cc: achew@airmonitor.com; dbeistel@airmonitor.com; Aaron Nissen; Bill Morgan; Ken Nielson
Subject: Intermountain OFA Kfactor questions

Dave,
As we discussed on the phone, I'd like you to review our Kfactor calculations.
The original data goes through the point of minimum flow with dampers closed at 0.008 in w.c. = 60,000 lb/hr flow.
But with the new Kfactors that Dan calculated, the minimum flow is nearly 160,000 lb/hr, which is way too high, that's nearly 60 percent of our OFA maximum flow. Can you review the calculations and see if they are reasonable or if there is some kind of error?
With all dampers closed, we expect the flow to be 50,000 lb/hr or lower.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Dan Beistel <dbeistel@airmonitor.com>
To: Jerry Finlinson <Jerry-F@ipsc.com>, Ken Nielson <KENNETH-N@ipsc.com>
Date: 5/24/2004 5:14 PM
Subject: RE: OFA corrections

Jerry,

The error will be the same with different size ducts. The flows may be different.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 6:53 PM
To: Ken Nielson
Cc: dbeistel@airmonitor.com
Subject: OFA corrections

Ken, I just noticed that Dan forgot to make corrections to the duct dimensions in all the OFA sheets.
Could you review which ones were 75 and 77 inches tall and enter that into the sheets, then enter those
flows into the Kfactor calc sheets. We'll be using the correction factors with no bias, this will give better close position flow rates.

Later, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Dan Beistel <dbeistel@airmonitor.com>
To: Jerry Finlinson <Jerry-F@ipsc.com>
Date: 5/24/2004 7:04 PM
Subject: RE: Intermountain U2 (& U1) OFA CAMS reading o/s

I think the bias is causing the zero to be high. Jerry look at the Factor sheet there is a section that has 3 k-factors and no bias. You can pick from the 3 gains, to accommodate your process.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 7:50 PM
To: dbeistel@airmonitor.com
Subject: RE: Intermountain U2 (& U1) OFA CAMS reading o/s

No, we don't think very much, but the CAMS says 160,000 lb/hr with the Kfactor gain and bias put in.
I just went and changed it to gain 1, with no bias, that brought it down significantly.
Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Dan Beistel <dbeistel@airmonitor.com> 5/24/2004 5:08:26 PM >>>
Is there that much leakage through the dampers?

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From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 10:45 AM
To: dbeistel@airmonitor.com; hossman@bellsouth.net
Cc: achew@airmonitor.com; mmaragos@airmonitor.com; Aaron Nissen; Bill Morgan; James Nelson; Jon Christensen; Ken Nielson
Subject: Fwd: Intermountain U2 (& U1) OFA CAMS reading o/s

Dan,
As you can see below our performance guys are having some major questions about the
overfire air flow in the dampers closed position. Unfortunately, when you were here, we didn't calibrate
the zero position. When you calibrated the 1/3 open , 2/3 dampersopen, and both open, the K-factor increased the zero flow significantly as well. Our overfire air permit requires them to shut off tighter than 5% total air, but right now in the shut off position we
are getting about 8% total air or 60% OFA flow of 160,000 lb/hr. I guess we can take the K-factor out, but we might prefer to redo it with

the zero flow point, then the 1/3 and 2/3. Is there any way to include

a curve fit correction? I guess we could do that in the DCS.
Later, Jerry

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OFA is out of service.

Any other ideas? Any help or support from the rest of you would be appreciated!!

From: Paresh Dave <pdave@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: Andy Chew <achew@airmonitor.com>, Matt Maragos <mmaragos@airmonitor.com>...
Date: 5/27/2004 11:46 AM
Subject: RE: Intermountain OFA K-factor questions
Attachments: 50600_OFA_Polynomials.xls

Jerry,

Please find attached the excel work sheet which shows the Polynomial equations for the four OFA measurements an the two PA measurements where you had used bias in the k-factor. These polynomials go through zero so at zero flow you will not have any bias or offset and would read true zero. Instead of using the k-factor in the CAMM units, you can take the flow in lb/hr from our CAMM and plug it in as X value in the equation to get corrected flow in lb/hr in DCS. Let me know if you have any questions.

Sincerely,

Paresh Dave'
Manager, Applications Engineering
Air Monitor Corporation
PH# 707-521-1711
FAX# 707-526-2825
pdave@airmonitor.com
<http://www.airmonitor.com>

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, May 24, 2004 3:25 PM
To: Paresh Dave
Cc: Andy Chew; Dan Beistel; Aaron Nissen; Bill Morgan; Ken Nielson
Subject: Intermountain OFA Kfactor questions

Dave,
As we discussed on the phone, I'd like you to review our Kfactor calculations.
The original data goes through the point of minimum flow with dampers closed at 0.008 in w.c. = 60,000 lb/hr flow.
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Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

Jerry Finlinson - Re: IPSC OFA pitots damaged.

From: "James Nelson" <nelsonj@compassminerals.com>
To: <Jerry-F@ipsc.com>
Date: 2/17/2005 2:53 PM
Subject: Re: IPSC OFA pitots damaged.

I believe they were just a 309 type material, Jerry. I'd make Borsig make you some new ones out of 253ma. I think theres a good chance they will stand good for it. Call Larry Bouche' and let him have it.

>>> Jerry Finlinson 02/17/05 02:40PM >>>
Ken,
Take a look at this Air Monitor pitot tube in our Babcock and Borsig OFA ports.
Apparently they are getting more radiation than they can handle. Can they be made of an even tougher material? Please advise.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Matt Maragos <mmaragos@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>, <khpquip@earthlink.net>
CC: <nelsonj@compassminerals.com>
Date: 2/17/2005 3:01 PM
Subject: RE: IPSC OFA pitots damaged.

Jerry,

Definitely. I am assuming that is high temperature corrosion (high O2 + high temp = reduction). We can make the VOLU-probes out of any material that is provided in tube or pipe. We have worked in Hastelloy, Inconnel, Hayes, 310 Stainless, etc.

Hastelloy would provide some more corrosion protection and is better for higher temperatures. Without knowing more specifics in regard to the mode of failure, we would probably recommend Hastelloy.

Any materials that you would recommend or that you are using at your plant?

Any idea on the maximum temperatures we are seeing?

Did something blow back into the duct? The cross brace in the picture looks a little affected.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, February 17, 2005 1:40 PM
To: mmaragos@airmonitor.com; khpquip@earthlink.net
Cc: nelsonj@compassminerals.com
Subject: IPSC OFA pitots damaged.

Ken,
Take a look at this Air Monitor pitot tube in our Babcock and Borsig OFA ports.
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435-864-6466 fax 0776/6670
jerry-f@ipsc.com

From: Matt Maragos <mmaragos@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: Ken Hall <khpquip@earthlink.net>
Date: 2/18/2005 7:52 AM
Subject: RE: IPSC OFA pitots damaged.

Jerry,

The 316 stainless steel probes are rated to 900°F. Our warranty covers defects in materials and workmanship, excessive heat damage would not be covered.

If it is strictly a heat issue, I would recommend Inconnel instead of Hastelloy. Inconnel will be good for temperatures up to 1900°F. Hastelloy is more for corrosion protection and temperature limit is *approx.* 1200°F.

Do you need a quotation?

Please let me know.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, February 17, 2005 6:16 PM
To: mmaragos@airmonitor.com
Subject: RE: IPSC OFA pitots damaged.

I'm pretty sure that is just radiation from the boiler.
We have seen our burner nozzle tips get up over 1600F, in the out of service condition with minimal cooling air. Probably the OFA ports are getting
that same time of heat from fireball radiation.

So how much would it cost to make from Hastelloy?
Is there any warranty on these, they are less than 1 year old.
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Matt Maragos <mmaragos@airmonitor.com> 2/17/2005 3:01:04 PM >>>
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jerry-f@ipsc.com

From: Matt Maragos <mmaragos@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: Ken Hall <khpquip@earthlink.net>
Date: 2/18/2005 10:06 AM
Subject: RE: IPSC OFA pitots damaged.

Yes.

We'll have a quote to you shortly.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Friday, February 18, 2005 8:46 AM
To: mmaragos@airmonitor.com
Subject: RE: IPSC OFA pitots damaged.

Please do give us a quotation. Do you have a record of the dimensions?
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

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jerry-f@ipsc.com

From: Matt Maragos <mmaragos@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: <khpquip@earthlink.net>
Date: 3/21/2005 2:16 PM
Subject: RE: IPSC OFA pitots damaged.
Attachments: 022305 Intermountain Power - Spares_Repls.pdf

Jerry,

I have attached the previous proposal.

I will check on the quickest lead time for the Inconnel, but I think that it will be at least 3-4 weeks. We do not keep a stock of Inconnel at the factory.

We have all of the parameters in our system.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, March 21, 2005 11:50 AM
To: mmaragos@airmonitor.com
Cc: khpquip@earthlink.net
Subject: RE: IPSC OFA pitots damaged.

Matt,
As I recall you sent me a quote for a new OFA pitot made of Inconel. I can't find that email, can you please send it again.
Also we wonder on the delivery. Could we get 2 probes by next Wednesday. Let me know and if we could get them in time, I'll try to get some on order.

You have the right length and parameters of our system, correct?

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Matt Maragos <mmaragos@airmonitor.com> 2/18/2005 10:05:49 AM >>>
Yes.

We'll have a quote to you shortly.

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Friday, February 18, 2005 8:46 AM
To: mmaragos@airmonitor.com
Subject: RE: IPSC OFA pitots damaged.

Please do give us a quotation. Do you have a record of the dimensions?
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Matt Maragos <mmaragos@airmonitor.com> 2/18/2005 7:52:10 AM >>>
Jerry,

The 316 stainless steel probes are rated to 900°F. Our warranty covers defects in materials and workmanship, excessive heat damage would not be covered.

If it is strictly a heat issue, I would recommend Inconnel instead of Hastelloy. Inconnel will be good for temperatures up to 1900°F. Hastelloy is more for corrosion protection and temperature limit is approx. 1200°F.

Do you need a quotation?

Please let me know.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, February 17, 2005 6:16 PM
To: mmaragos@airmonitor.com
Subject: RE: IPSC OFA pitots damaged.

I'm pretty sure that is just radiation from the boiler.
We have seen our burner nozzle tips get up over 1600F, in the out of service condition with minimal cooling air. Probably the OFA ports are getting
that same time of heat from fireball radiation.

So how much would it cost to make from Hastelloy?
Is there any warranty on these, they are less than 1 year old.
Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

>>> Matt Maragos <mmaragos@airmonitor.com> 2/17/2005 3:01:04 PM >>>
Jerry,

Definitely. I am assuming that is high temperature corrosion (high O2 + high temp = reduction). We can make the VOLU-probes out of any material that is provided in tube or pipe. We have worked in Hastelloy, Inconnel, Hayes, 310 Stainless, etc.

Hastelloy would provide some more corrosion protection and is better for higher temperatures. Without knowing more specifics in regard to the mode of failure, we would probably recommend Hastelloy.

Any materials that you would recommend or that you are using at your plant?

Any idea on the maximum temperatures we are seeing?

Did something blow back into the duct? The cross brace in the picture looks a little affected.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, February 17, 2005 1:40 PM
To: mmaragos@airmonitor.com; khpquip@earthlink.net
Cc: nelsonj@compassminerals.com
Subject: IPSC OFA pitots damaged.

Ken,
Take a look at this Air Monitor pitot tube in our Babcock and Borsig OFA ports.
Apparently they are getting more radiation than they can handle. Can they be made of an even tougher material? Please advise.

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

AMC POWER
a division of Air Monitor Corporation

Date February 23, 2005
No. of Pages 2
(includes this page)

To:	Jerry Finlinson Intermountain Power	From:	Matt Maragos AMC Power
Fax:		Fax:	(707) 526-9970
Phone:	(435) 864-6466	Phone:	(707) 521-1731
E-Mail:	Jerry-F@ipsc.com	E-Mail:	mmaragos@airmonitor.com
cc:	Ken Hall – PowerQuip		

☐ URGENT ☒ FOR YOUR REVIEW ☐ PLEASE COMMENT

RE: Spare/Replacement IBAM Probe and OFA VOLU-probes
Proposal Number: 022305-10.1

Jerry,

Per your request, please this proposal for the spare / replacement IBAM probes and OFA probes.

We have provided pricing for both a stainless steel OFA probe (exact replacement for the existing probes) and for an OFA probe constructed of Inconel. Inconel material is good for operational temperatures up to 1900°F (the 316 stainless steel is rated to 900°F).

Price for One (1) IBAM Probe (316 Stainless Steel Construction) ..... $695.

Price for One (1) 39.5" OFA VOLU-probe/1SS (316 Stainless Steel Construction) .....$920.

Price for One (1) 39.5" OFA VOLU-probe/1SS-SPL (Inconel Construction).....$1 ,590.

All prices in United States Dollars.

Shipping Schedule: 6-8 weeks after approval of submittal drawings or order release. Submittal drawings will be completed within 3 weeks after receipt of order.
Terms: Net 30 Days.
F.O.B: Santa Rosa, CA.

This proposal is valid for 60 days.

Proven solutions for a tough industry

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

Matt Maragos
AMC Power

Proven solutions for a tough industry

From: Matt Maragos <mmaragos@airmonitor.com>
To: 'Jerry Finlinson' <Jerry-F@ipsc.com>
CC: <troyhaun@powerquip.net>
Date: 4/7/2005 3:55 PM
Subject: RE: Intermountain final submittal sheet wanted for OFA.
Attachments: 51157 R1 As Installed Submittal 3-24-04.pdf

Jerry,

Here you go.

Please advise if you have any questions or concerns.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, April 07, 2005 1:44 PM
To: mmaragos@airmonitor.com
Cc: troyhaun@powerquip.net
Subject: Intermountain final submittal sheet wanted for OFA.

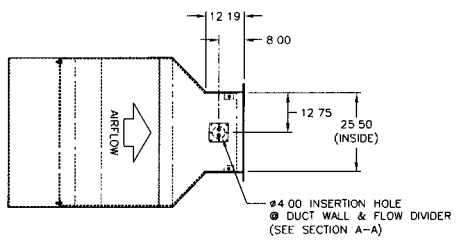
Matt,
We are trying to find some documentation on our overfire air project.
I think the project number is 50600.
Anyway, it was the project done in 2003 and 2004 with Babcock Borsig and you
supplied the Pitots for individual OFA port airflow as well as the OFA Mass flow in each corner.

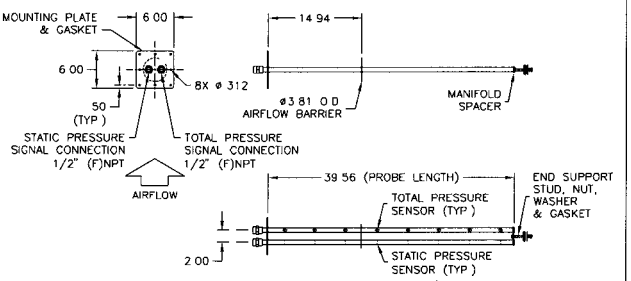
Could you send me a PDF of the final submittal sheet?

Thanks, Jerry

Jerry Finlinson, Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 fax 0776/6670
jerry-f@ipsc.com

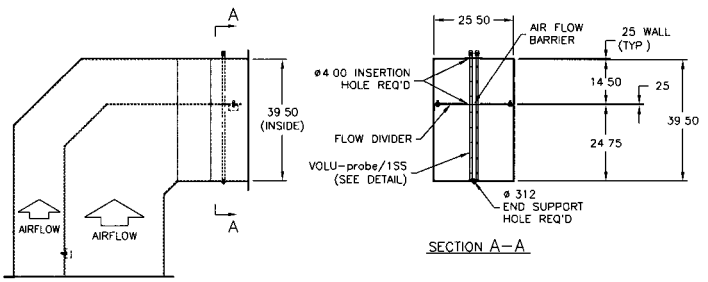
REV	DESCRIPTION	DATE	DWN	APV
1	CERTIFIED CORRECT	12/29/03	SEL	AEC





VOLU-probe/1SS

QUANTITY 16



SECTION A-A

OFA DUCT - INDIVIDUAL PORT

PER BBP INC DWG 100210-7237120-00
ID# 100210-72371207

NOTES

1 TYPICAL OF 16 INSTALLATIONS

PROJECT

INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600

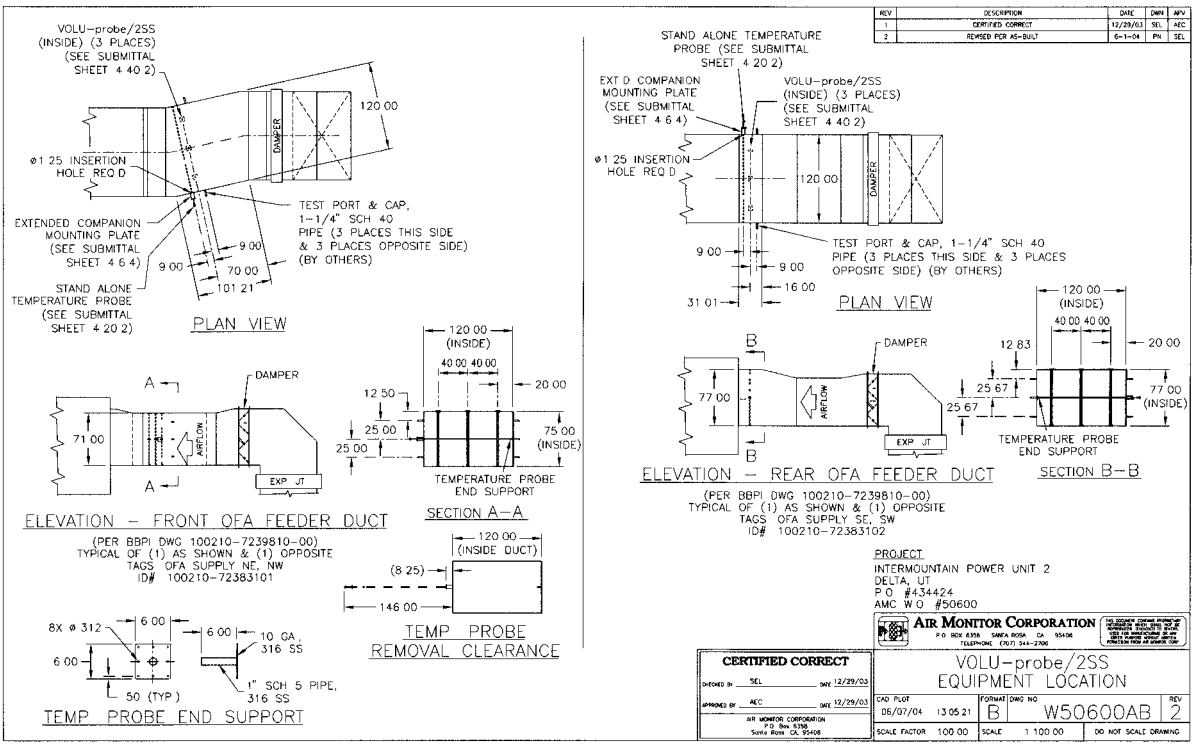
FEATURE	MATERIAL
END SUPPORT STUD NUT, WASHER	ø5/16-18, TYPE 316 SS
GASKETS	HIGH TEMP CERAMIC FIBER
AIRFLOW BARRIER & MAN SPACER	14 GA TYPE 316 SS
T P & S P SIGNAL CONNECTIONS	1/2" FNPT, 316 SS
T P & S P SENSOR MANIFOLDS	ø 75 O D TUBE, 316 SS
MOUNTING PLATE	10 GA TYPE 316 SS

AIR MONITOR CORPORATION
P.O BOX 6238 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706

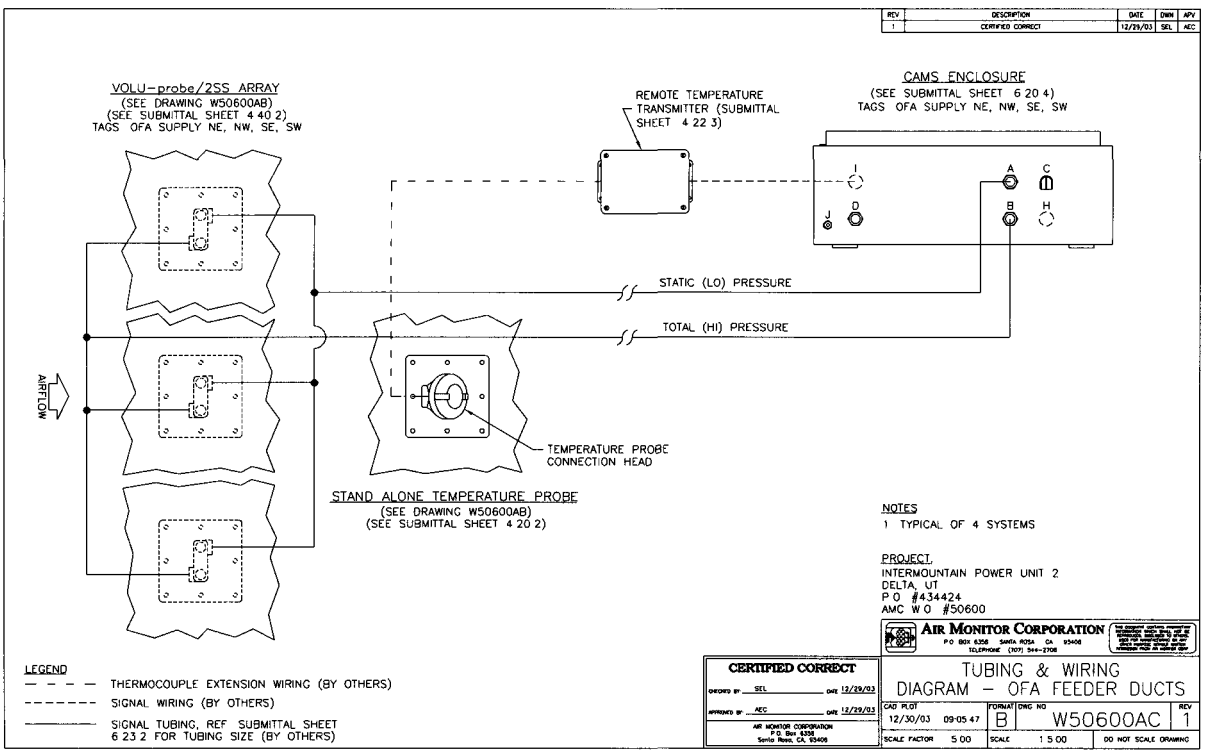
CERTIFIED CORRECT
DRAWN BY SEL DATE 12/29/03
APPROVED BY AEC DATE 12/29/03
AIR MONITOR CORPORATION
P.O. Box 6238
Santa Rosa, CA 95406

VOLU-probe/1SS
EQUIPMENT LOCATION - OFA PORTS

CAD PLOT	FORMAT	DWG NO	REV
12/30/03 08 54 59	B	W50600AA	1
SCALE FACTOR 24 00	SCALE 1 24 00	DO NOT SCALE DRAWING	


VOLU-probe/2SS (INSIDE) (3 PLACES) (SEE SUBMITTAL SHEET 4 40 2)
120 00
DAMPER
ø1 25 INSERTION HOLE REQ D
TEST PORT & CAP, 1-1/4" SCH 40 PIPE (3 PLACES THIS SIDE & 3 PLACES OPPOSITE SIDE) (BY OTHERS)
EXTENDED COMPANION MOUNTING PLATE (SEE SUBMITTAL SHEET 4 6 4)
9 00
9 00
70 00
101 21
STAND ALONE TEMPERATURE PROBE (SEE SUBMITTAL SHEET 4 20 2)
PLAN VIEW
A
DAMPER
71 00
AIRFLOW
EXP JT
A
ELEVATION - FRONT OFA FEEDER DUCT
(PER BBPI DWG 100210-7239810-00)
TYPICAL OF (1) AS SHOWN & (1) OPPOSITE
TAGS OFA SUPPLY NE, NW
ID# 100210-72383101
120 00
(INSIDE)
40 00 40 00
20 00
12 50
25 00
25 00
75 00
(INSIDE)
TEMPERATURE PROBE END SUPPORT
SECTION A-A
120 00
(INSIDE DUCT)
(8 25)
146 00
TEMP PROBE REMOVAL CLEARANCE
8X ø 312
6 00
6 00
6 00
10 GA, 316 SS
50 (TYP)
1" SCH 5 PIPE, 316 SS
TEMP PROBE END SUPPORT
STAND ALONE TEMPERATURE PROBE (SEE SUBMITTAL SHEET 4 20 2)
EXT D COMPANION MOUNTING PLATE (SEE SUBMITTAL SHEET 4 6 4)
VOLU-probe/2SS (INSIDE) (3 PLACES) (SEE SUBMITTAL SHEET 4 40 2)
ø1 25 INSERTION HOLE REQ D
120 00
DAMPER
TEST PORT & CAP, 1-1/4" SCH 40 PIPE (3 PLACES THIS SIDE & 3 PLACES OPPOSITE SIDE) (BY OTHERS)
9 00
9 00
16 00
31 01
PLAN VIEW
B
DAMPER
77 00
AIRFLOW
EXP JT
B
ELEVATION - REAR OFA FEEDER DUCT
(PER BBPI DWG 100210-7239810-00)
TYPICAL OF (1) AS SHOWN & (1) OPPOSITE
TAGS OFA SUPPLY SE, SW
ID# 100210-72383102
120 00
(INSIDE)
40 00 40 00
12 83
20 00
25 67
25 67
77 00
(INSIDE)
TEMPERATURE PROBE END SUPPORT
SECTION B-B
REV DESCRIPTION DATE DWN APV
1 CERTIFIED CORRECT 12/29/03 SEL AEC
2 REVISED PER AS-BUILT 6-1-04 PN SEL
PROJECT
INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600
AIR MONITOR CORPORATION
P O BOX 6358 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706
CERTIFIED CORRECT
CHECKED BY SEL DATE 12/29/03
APPROVED BY AEC DATE 12/29/03
AIR MONITOR CORPORATION P.O. Box 6358 Santa Rosa CA. 95406
VOLU-probe/2SS
EQUIPMENT LOCATION
CAD PLOT 06/07/04 13:05:21
FORMAT B
DWG NO W50600AB
REV 2
SCALE FACTOR 100 00
SCALE 1 100 00
DO NOT SCALE DRAWING

IP7_027263


REV | DESCRIPTION | DATE | DWN | APV
1 | CERTIFIED CORRECT | 12/29/03 | SEL | AEC
VOLU-probe/2SS ARRAY
(SEE DRAWING W50600AB)
(SEE SUBMITTAL SHEET 4 40 2)
TAGS OFA SUPPLY NE, NW, SE, SW
REMOTE TEMPERATURE TRANSMITTER (SUBMITTAL SHEET 4 22 3)
CAMS ENCLOSURE
(SEE SUBMITTAL SHEET 6 20 4)
TAGS OFA SUPPLY NE, NW, SE, SW
I
A
C
J
D
B
H
STATIC (LO) PRESSURE
TOTAL (HI) PRESSURE
AIRFLOW
TEMPERATURE PROBE CONNECTION HEAD
STAND ALONE TEMPERATURE PROBE
(SEE DRAWING W50600AB)
(SEE SUBMITTAL SHEET 4 20 2)
NOTES
1 TYPICAL OF 4 SYSTEMS
PROJECT
INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600
AIR MONITOR CORPORATION
P O BOX 6358 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706
LEGEND
THERMOCOUPLE EXTENSION WIRING (BY OTHERS)
SIGNAL WIRING (BY OTHERS)
SIGNAL TUBING, REF SUBMITTAL SHEET 6 23 2 FOR TUBING SIZE (BY OTHERS)
CERTIFIED CORRECT
CHECKED BY SEL DATE 12/29/03
APPROVED BY AEC DATE 12/29/03
AIR MONITOR CORPORATION P O Box 6358 Santa Rosa, CA 95406
TUBING & WIRING DIAGRAM - OFA FEEDER DUCTS
CAD PLOT 12/30/03 09:05:47
FORMAT B
DWG NO W50600AC
REV 1
SCALE FACTOR 5.00
SCALE 1 5.00
DO NOT SCALE DRAWING

IP7_027264

SUBMITTAL SHEET

VOLU-probe / 1SS – INDUSTRIAL
EXTERNALLY MOUNTED
STAINLESS STEEL AIRFLOW TRAVERSE PROBE

STANDARD CONSTRUCTION

Probe.	½", ¾", or 1" tube sensing manifolds, threaded end support, washer and nut, mounting plate, signal connection fittings, and identification tag, all fabricated of Type 316 stainless steel Neoprene gaskets included
Mounting.	External duct mounted Threaded end support for probes greater than 18" long
Connection Fittings.	½" FPT stainless steel
Operating Temperature.	Continuous operation to 900°F

PERFORMANCE SPECIFICATIONS

Accuracy.	2-3%, dependent upon quantity and placement of probes to achieve traverse of ducted airflow
Outputs.	Individually averaged signals of total and static pressure
Operating Velocity.	100-10,000 FPM
Directional Sensitivity.	Not measurably affected by directional airflows and pitch and yaw angles up to 30°
Traverse Pattern.	On an equal area basis for rectangular probes On an equal concentric area basis for circular probes
Resistance.	Less than 0 1 times the velocity pressure head at probe operating velocity

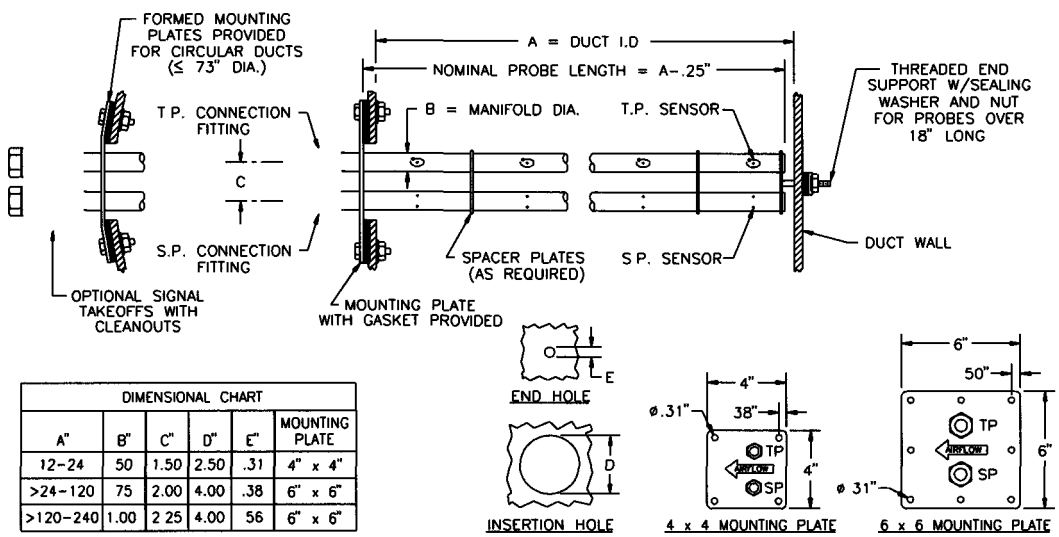
OPTIONAL CONSTRUCTION

Connection Fitting.
- ❑ ¼" Compression
- ❑ ½" Compression

Signal Connection.
- ❑ Cleanout

High Temperature Gaskets.
- ❑ Silicone, for continuous operation between 200°F and 400°F
- ❑ Fiber, for continuous operation between 400°F and 900°F

DIMENSIONAL SPECIFICATIONS



DIMENSIONAL CHART					
A"	B"	C"	D"	E"	MOUNTING PLATE
12-24	50	1.50	2.50	.31	4" x 4"
>24-120	75	2.00	4.00	.38	6" x 6"
>120-240	1.00	2 25	4.00	56	6" x 6"

AIR MONITOR CORPORATION

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4.36.2

SUBMITTAL SHEET

VOLU-probe / 2SS – INDUSTRIAL
INTERNALLY MOUNTED
STAINLESS STEEL AIRFLOW TRAVERSE PROBE

STANDARD CONSTRUCTION

Probe.	½", ¾" or 1" tube sensing manifolds, mounting plates, signal connection fittings, and identification tag, all fabricated of Type 316 stainless steel
Mounting.	Internal duct mounted Dual end mounting plates
Connection Fittings.	½" FPT stainless steel
Operating Temperature.	Continuous operation to 900°F

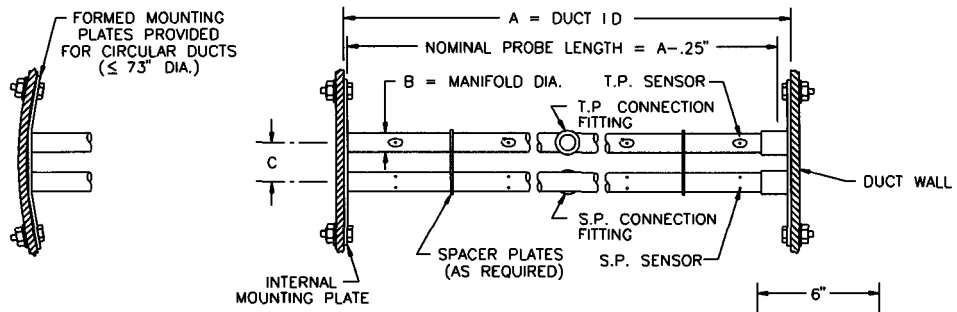
PERFORMANCE SPECIFICATIONS

Accuracy.	2-3%, dependent upon quantity and placement of probes to achieve traverse of ducted airflow
Outputs.	Individually averaged signals of total and static pressure
Operating Velocity.	100-10,000 FPM
Directional Sensitivity.	Not measurably affected by directional airflows with pitch and yaw angles up to 30°
Traverse Pattern.	On an equal area basis for rectangular probes On an equal concentric area basis for circular probes
Resistance.	Less than 0 1 times the velocity pressure head at probe operating velocity

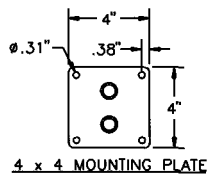
CONNECTION FITTINGS.

- ❑ ¼" Compression
- ❑ ½" Compression

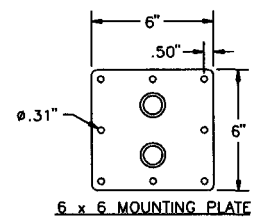
DIMENSIONAL SPECIFICATIONS



DIMENSIONAL CHART			
A"	B"	C"	MOUNTING PLATE
12-24	50	1.50	4" x 4"
>24-120	75	2.00	6" x 6"
>120-240	1.00	2 25	6" x 6"



4 x 4 MOUNTING PLATE



6 x 6 MOUNTING PLATE

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IP7_027266

SUBMITTAL SHEET

VOLU-probe, VOLU-probe/SS, & VOLU-probe/VS
MINIMUM INSTALLATION REQUIREMENTS

INSTALLATION CONSIDERATIONS Installation factors to be considered when applying the VOLU-probe are as follows:

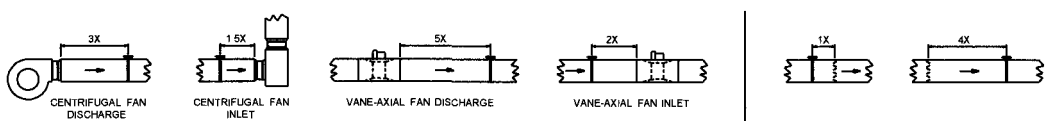
Turbulent Airflow. The unique design of the total and static pressure sensors of the VOLU-probe will permit accurate flow measurement in the presence of moderate air turbulence. The distances from air turbulence producing fittings, transitions, etc., shown below in the Minimum Requirements for Installation, are required to assure accurate VOLU-probe operation.

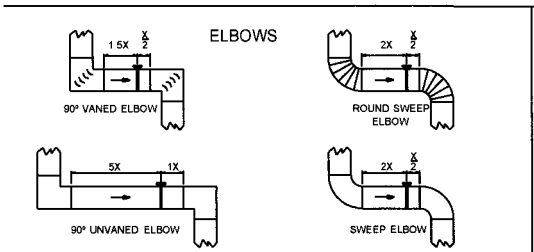
Stratified Airflow. The VOLU-probe should be mounted so that the probe crosses any stratified airflow - not parallel to the flow. This mounting arrangement will permit the probe to sense the wide range of velocity profiles present in a stratified airflow.

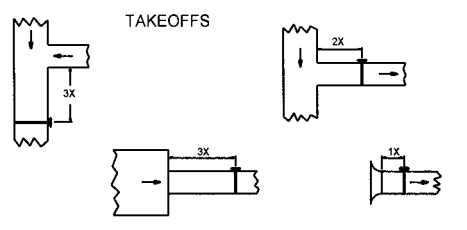
Airborne Contaminants. The levels of air filtration and cleanliness associated with commercial HVAC Systems, whether supply/return/exhaust/outside air, are satisfactory for operation of the VOLU-probe. Industrial applications containing airborne contaminants may require periodic manual or automatic cleaning using compressed air applied to the signal fittings, and/or removal from the duct or stack for physical cleaning.

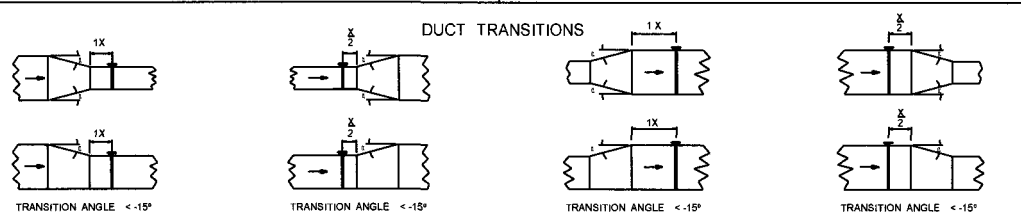
Direction of Airflow. The VOLU-probe will function only with the probe mounted so that the total pressure sensor holes are directed into the approaching airstream. To prevent improper installation, each VOLU-probe is marked with an arrow indicating the required direction of airflow.

MINIMUM REQUIREMENTS FOR INSTALLATION **Note: VOLU-probe locations shown are NOT ideal.** They indicate the minimum clearance required from air turbulence producing sources. Wherever possible, the VOLU-probe should be installed where greater runs of straight duct (or clearances) than shown exist.









Rectangular Duct $x = \frac{2(H \times W)}{H + W}$ Circular Duct x = Duct Diameter

P.O. Box 6358 • Santa Rosa, CA 95406 ▯ (707) 544-2706 ▯ (707) 526-2825 Fax

AIR MONITOR CORPORATION

4.23.2

SUBMITTAL SHEET

TEMPERATURE PROBE
SINGLE POINT
SELF-SUPPORTED

NOTE: USE COMPANION MOUNTING PLATE TO MOUNT TEMPERATURE PROBE ASSEMBLY SEE SUBMITTAL SHEET 4.6.4

STANDARD CONSTRUCTION

Temperature Element.	100 ohm platinum RTD or Thermocouple
Temperature Element Sheathing.	¼" diameter RTD or ½" diameter Thermocouple, 316 stainless steel
Temperature J-Box.	NEMA 4 cast aluminum
Temperature Transmitter.	2-wire, 4-20mA non-isolated, linearized output (24 to 40VDC loop power required)
Mounting Plate.	6" x 6", 316 stainless steel
Support Tube.	316 stainless steel

PERFORMANCE SPECIFICATIONS

RTD Element Accuracy.	± 1 Ω @ °C, per SAMA RC21-4-1966
Thermocouple Accuracy.	Per ANSI Circular MC 96 1-1982
RTD Temperature Coefficient (Alpha).	0 00385
Temperature Transmitter Range.	0 to 750°F

OPTIONS

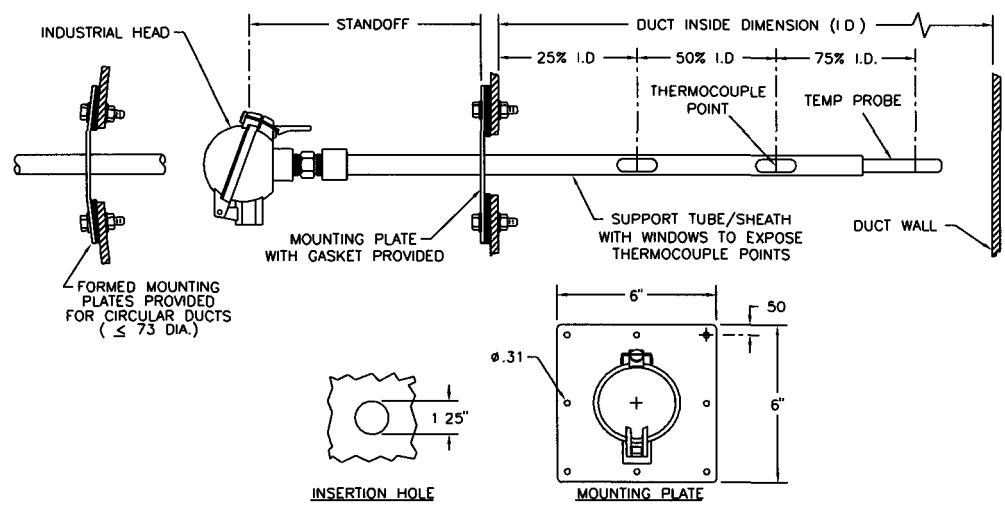
Thermocouple Type.
☐ K ☒ E ☐ J

Standoff.
☐ 9" (standard)
☐ Other _____

High Temperature Gasket.
☐ Silicone, 200°F to 400°F
☒ Fiber, 400°F to 900°F

Transmitter Type.
☐ Optically Isolated

DIMENSIONAL SPECIFICATIONS



* NOTE PROBES OVER 72" LONG MAY REQUIRE A CENTER STRUCTURAL SUPPORT (BY OTHERS). CONTACT FACTORY.

P.O. Box 6358 • Santa Rosa, CA 95406 • (707) 544-2706 • (707) 526-2825 Fax

AIR MONITOR CORPORATION

SUBMITTAL SHEET

COMPANION MOUNTING PLATE, EXTENDED
FOR MOUNTING TO FLAT CARBON STEEL DUCTS

STANDARD CONSTRUCTION

Plate.	¼" thick carbon steel plate
Fasteners.	¼-20 studs, lockwashers, and nuts
Standoff.	Schedule 40 pipe, carbon steel

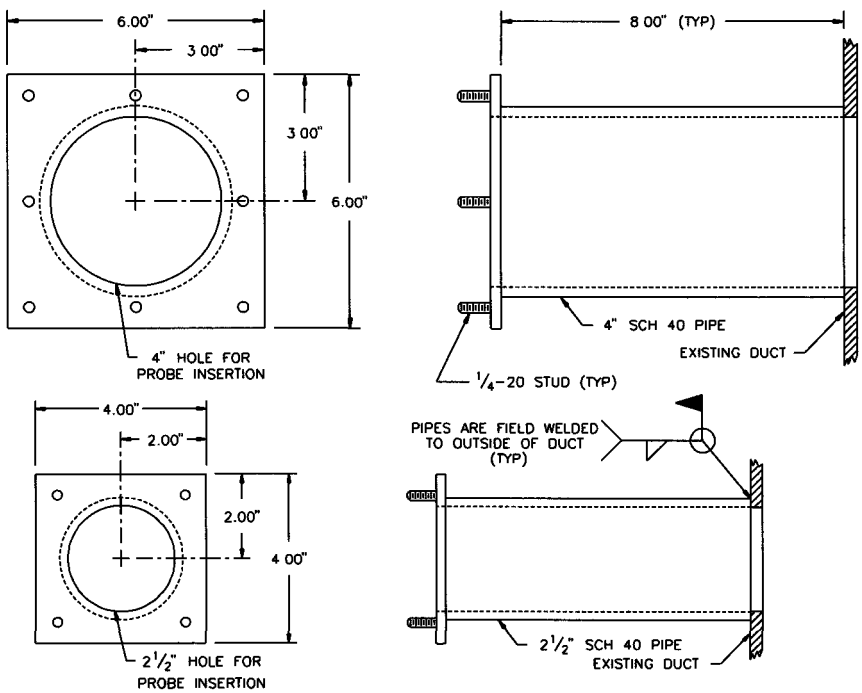
FUNCTION

This extended plate provides a means for mounting stainless steel VOLU-probes to the outside of insulated ducts

OPTIONAL SIZES

- ☐ 4" x 4" plate with 2½" Schedule 40 pipe For probes 12" to 24" long
- ☑ 6" x 6" plate with 4" Schedule 40 pipe For probes > 24" to 240" long

DIMENSIONAL SPECIFICATIONS (inches)



AIR MONITOR CORPORATION

P.O. Box 6358 • Santa Rosa, CA 95406 • (707) 544-2706 • (707) 526-2825 Fax

SUBMITTAL SHEET

REMOTE TEMPERATURE TRANSMITTER ENCLOSURE
PROCESS TEMPERATURES ≥300°F

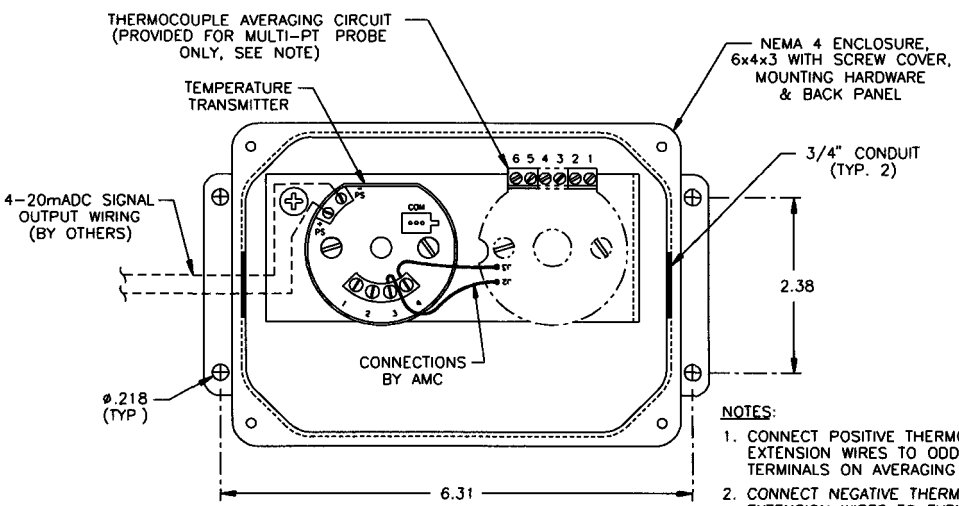
FUNCTION

To provide a non-isolated, linear to temperature, 4-20mADC signal from the temperature probe The transmitter is mounted in a NEMA 4 steel enclosure which is to be mounted in a remote location where the ambient temperature will not exceed 120°F. Interconnect wire by others

OPTIONS

Optically Isolated Output

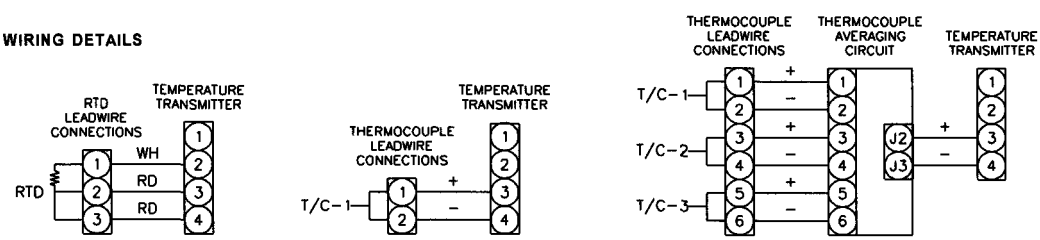
DIMENSIONAL SPECIFICATIONS



NOTES:

1. CONNECT POSITIVE THERMOCOUPLE EXTENSION WIRES TO ODD NUMBER TERMINALS ON AVERAGING BOARD
2. CONNECT NEGATIVE THERMOCOUPLE EXTENSION WIRES TO EVEN NUMBER TERMINALS ON AVERAGING BOARD.

WIRING DETAILS



RTD — 1-Point Thermocouple — 3-Point Thermocouple

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SUB-K010, Rev 1 (8/98)

IP7_027270

SUBMITTAL SHEET

TEMPERATURE TRANSMITTER
2-WIRE, LOOP POWER, 4-20mA

PERFORMANCE SPECIFICATIONS

				Conformance Range
Input Accuracy.	RTD	±0 04%	@ 77°F	–328°F to +1562°F
	Thermocouple, Type E	±0 022%	of Conformance Range	–274°F to +1832°F
	Thermocouple, Type J	±0 03%	of Conformance Range	–292°F to +1418°F
	Thermocouple, Type K	±0 02%	of Conformance Range	–238°F to +2502°F

Output Accuracy. RTD and Single Point Thermocouples ±0 03% of Input Span Setting + Input Accuracy
Multi-Point Thermocouples ±0 03% of Input Span + Input Accuracy + Averaging Circuit Accuracy
Averaging Circuit Accuracy (%) $\frac{.02 \times (\text{Temp Gradient °F})}{(\text{Transmitter Span °F})} \times 100$

Cold Junction Reference Accuracy ±0 045%

Isolation. 1500 Vrms input to output to case (Isolated Model only)

Linearity. 0 1% of span, within rated ranges

Over-Voltage Protection. 4V max (Input), 48V max (Output and Reverse Polarity protection on Output)

Load Capability. 500Ω @ 24V, typical
Non-Isolated Model $\frac{\text{Supply Voltage - 7V}}{024\text{A}} = \Omega$ Isolated Model $\frac{\text{Supply Voltage - 10V}}{024\text{A}} = \Omega$

Burnout Protection. Total Sensor Diagnostics user-selected via Windows configuration software, upscale to 24mA (std) or downscale to 3 6mA Applies when all sensors in the temperature probe are burned out

Output Current Limiting. 21 4mA for input over-range, 23 6mA for sensor failure or broken wire

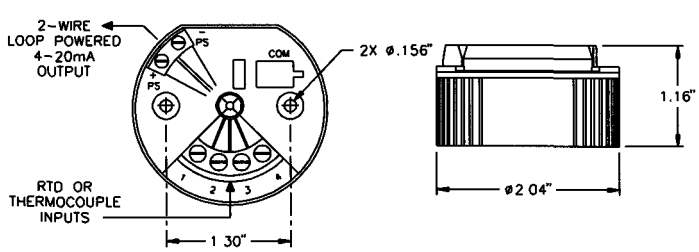
RTD Lead Wire Resistance Maximum. RTD Resistance + 2 times the lead wire resistance must be less than 400Ω Recommend <35Ω per wire for 3-wire RTD inputs

AMBIENT CONDITIONS

Operating and Storage Range.	–40°F to +185°F
Relative Humidity.	0-95%, non-condensing
Effect of Ambient Temp on Accuracy.	±0.015% of span per °F change, max (+0 001% of Ω reading for RTD inputs)
Effect of Ambient Temp on Cold Junction Compensation.	±0 015°F per °F change

ADJUSTMENTS All settings made using Windows based configuration program, then stored in non-volatile FRAM memory Cable, software disk and instruction manual included with each transmitter

OPTIONS **Transmitter Type.** — Non-Isolated (standard) Optically Isolated



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IP7_027271

SUBMITTAL SHEET

CAMS
COMBUSTION AIRFLOW MANAGEMENT SYSTEM

STANDARD CONSTRUCTION

☑ Brass and Copper Construction

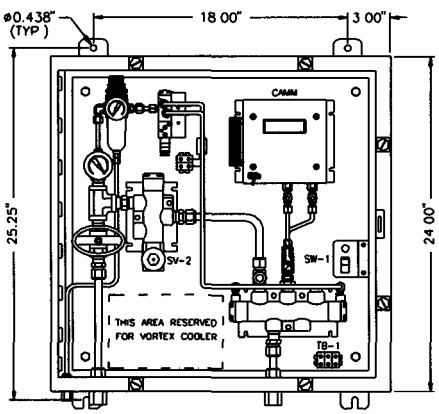
All wetted tubing, fittings, and valves constructed of copper and/or brass
Enclosure is NEMA 4 painted steel
External connection fittings are stainless steel FPT

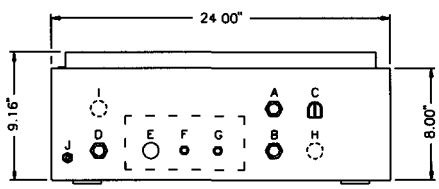
OPTIONAL CONSTRUCTION

☐ NEMA 4X Stainless Steel Enclosure
☐ Vortex Cooler
☑ Viewing window

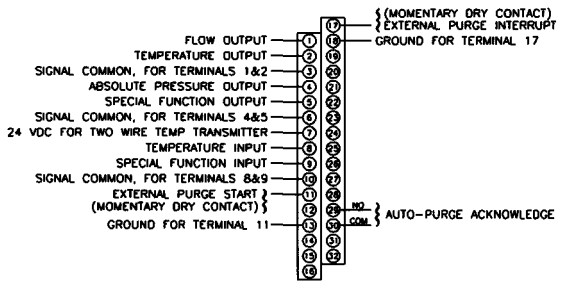
Power Supply
☐ 24VAC, 54VA
☐ 24VDC, 48VA
☑ 120VAC, 108VA

DIMENSIONAL SPECIFICATIONS

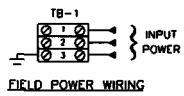




BOTTOM VIEW



FIELD CAMM WIRING



FIELD POWER WIRING

CONNECTION CODE.

A	STATIC PRESSURE, FROM FLOW STATION	½" FPT
B.	TOTAL PRESSURE, FROM FLOW STATION	½" FPT
C	CABINET VENT	ø0.75"
D	SUPPLY AIR 80–125 PSIG	½" FPT
E	VORTEX COOLER MOUNTING HOLE	ø1.125" I.D. (OPTIONAL)
F	VORTEX COOLER FILTER DRAIN	1/4" FPT (OPTIONAL)
G.	VORTEX COOLER AIR SUPPLY	1/4" FPT (OPTIONAL)
H.	ELECTRICAL CONNECTION POWER WIRING	¾" K.O. (BY OTHERS)
I	ELECTRICAL CONNECTION SIGNAL WIRING	¾" K.O. (BY OTHERS)
J	SUPPLY AIR FILTER DRAIN	¼" FPT

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SUBMITTAL SHEET

CAMM

COMBUSTION AIRFLOW MANAGEMENT MODULE

OPTIONS

Special Functions
- Summed Flow
- Differential Flow

Power
- 24VAC
- 20-40VDC
- 120VAC (via external transformer)

Certification
- Standard
- NIST Traceable

PERFORMANCE SPECIFICATIONS

Accuracy.
±0 1% of Natural Span, including non-linearity, hysteresis, and non-repeatability

Stability.
±0 5% of Natural Span for six months

Temperature Effect
Zero None, corrected by AUTO-zero
Span 0 015% of Full Span/°F

Mounting Position Effect.
None, corrected by AUTO-zero

Transducer Response Time.
0 5 second to reach 98% of a step change

Power Consumption.
54VA at 24VAC, 48VA at 24VDC, and 108VA at 120VAC

FUNCTIONAL SPECIFICATIONS

Digital Outputs.
Dual Form 'A' dry contacts for AUTO-purge activation and acknowledgment.

Digital Inputs.
Dry contacts for AUTO-purge external start and purge interrupt commands

Analog Outputs.
Four outputs for flow, temperature, absolute pressure, and special function individually configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC

Analog Inputs.
Dual inputs are field configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC One is reserved for temperature input, the other for use with optional special function

AUTO-purge Management.
AUTO-purge cycle is initiated via an external dry contact input, or via an internal timer with field selectable frequencies of 1 to 24 hours, in 1 hour increments An Form 'A' contact controls the AUTO-purge System, a second dry contact provides remote purge activation acknowledgment

Power Supply.
Standard 24VAC (20-28VAC) or 24VDC (20-40VDC), with automatic selection Optional 120VAC (100-132 VAC) via external UL listed transformer

Low Pass Filtration.
Response time to reach 98% of a step change is adjustable from 2 0 to 30 0 seconds

Automatic Zeroing.
Accuracy Within 0 1% of calibrated span
Frequency. Every 1 to 24 hours selectable on 1 hour intervals

Overpressure and Static Pressure Limit.
25 psig

Circuit Protection.
Power input is fused and reverse polarity protected

Span and Zero Adjustment.
Digital, via internally located push-buttons

Displays.
Standard 4 line x 20 character LCD provides four lines of data display corresponding to the four analog outputs

Temperature Compensation Selection.
Push-button selection of linearized or nonlinear input Choice of thermocouple (Type E, K, J, and T) or 100 ohm platinum RTD temperature sensor type

Pressure Compensation.
Absolute pressure (atmosphere or duct static), up to 60"Hg

Humidity Limits.
0-95% RH, non-condensing

Temperature Limits.
–20°F to 180°F Storage
+40°F to 140°F Operating

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SUBMITTAL SHEET

CAMM

COMBUSTION AIRFLOW MANAGEMENT MODULE

PHYSICAL SPECIFICATIONS

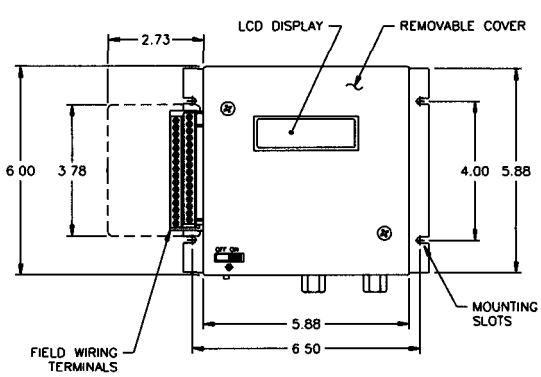
Signal Connections.
High and low pressure, 1/8" FPT

Electrical Connections.
External terminal strip with plug-in connectors.

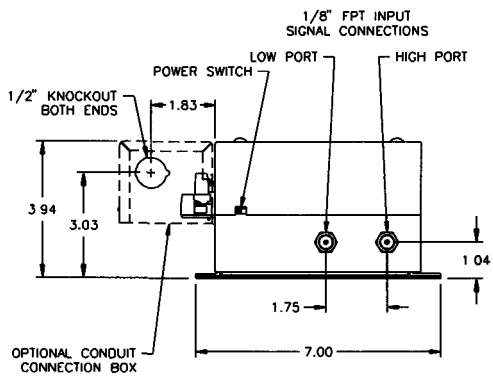
Enclosure.
NEMA 1 aluminum enclosure

Weight.
4 1 lbs

DIMENSIONAL SPECIFICATIONS

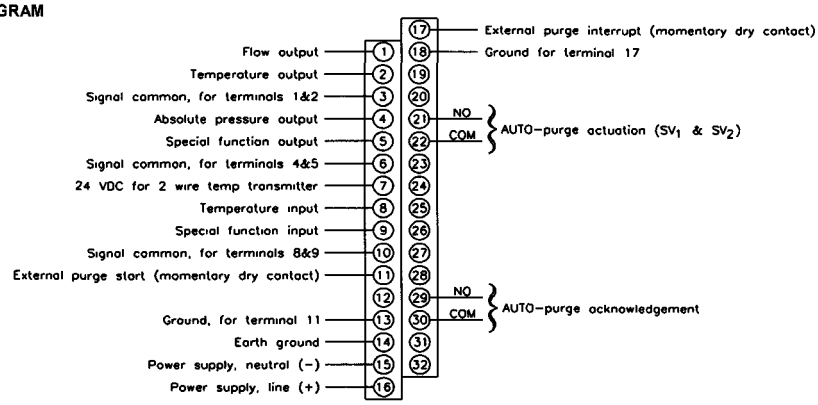


FRONT VIEW



BOTTOM VIEW

WIRING DIAGRAM



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SUB-B019, Rev 5 (10/02)

IP7_027274

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT: **INTERMOUNTAIN POWER**

WORK ORDER: **50600** *REV:* **2**

TAG(S): **FRONT OFA FEEDER DUCT (75" x 120")**

Given Information:

Fluid:	**AIR**		% H_2O (by volume)	
Standard Temperature (T_{std}):	**68**	(deg. F)	**0.00**	(%, by volume)
Standard Barometric Pressure (P_{std}):	**29.921**	(in. Hg)		
Air Temperature (T):	**750**	(deg. F)	Maximum Flow:	
Stack/Duct Pressure (P_g):	**0.00**	(in. w.c.)	**387,000**	(lb/hr)
Actual Barometric Pressure (P_{bar}):	**24.000**	(in. Hg)	**Wet**	(Wet/Dry)
Air Density at Standard Conditions, DRY:	**0.07513**	(lbs/ft^3)		
Duct Shape:	**RECT**		Square Root Extraction? (Yes/No)	
Duct Height:	**75.000**	(in.)	**Yes**	
Duct Width:	**120.000**	(in.)		
			Output:	
			4-20 mADC	

Calculations:

Duct Area (A_s):	62.500	(ft^2)
Maximum Actual Velocity:	3,924	(AFPM)
Absolute Duct Pressure (P_s):	24.000	(in. Hg)
Dry Mole Fraction of Duct (Mfd):	1.000	
Dry Molecular Wt. Of Air (Md):	28.965	(lb/lb-mole)
Wet Molecular Wt. Of Air (Ms):	28.965	(lb/lb-mole)
Air Density at Standard Conditions, WET:	0.07513	(lbs/ft^3)
Air Density at Actual Conditions, WET:	0.02630	(lbs/ft^3)

K-Factor: OFF

% FLOW (%)	Diff Press (in. w.c.)	Output (mADC)	Actual Flow (ACFM)	Std Flow/Dry (SCFM)	Std Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0.0000	4.00	00000				
10	0.0034	5.60	24,528	8,585	8,585	38,700	38,700
20	0.0135	7.20	49,055	17,170	17,170	77,400	77,400
30	0.0303	8.80	73,583	25,755	25,755	116,100	116,100
40	0.0538	10.40	98,111	34,340	34,340	154,800	154,800
50	0.0841	12.00	122,641	42,926	42,926	193,500	193,500
60	0.1211	13.60	147,169	51,511	51,511	232,200	232,200
70	0.1648	15.20	171,697	60,096	60,096	270,900	270,900
80	0.2152	16.80	196,224	68,681	68,681	309,600	309,600
90	0.2724	18.40	220,752	77,266	77,266	348,300	348,300
100	0.3363	20.00	245,280	85,851	85,851	387,000	387,000

Transmitter:	CAMM	Power (voltage/type):	24VAC
Flow Element:	VOLU-probe/SS w/Temp Probe	Power Configuration:	4-Wire
Transmitter Maximum Range:	0 - 387,000 LB/HR	Square Root:	ON
Temperature Range:	0 to 750°F	Density Compensation:	ON
Pressure Comp. Range:	24.00 to 32.00 in. Hg		

Temperature Sensor: 3-Pt. Type "E" T/C Probe with remote 4-20mADC temperature transmitter.

Display Line #1:	0 - 387,000 LB/HR	(FLOW)
Display Line #2:	0 to 750°F	(TEMPERATURE)
Display Line #3:	24.00 to 32.00 in. Hg	(ABSOLUTE PRESSURE)
Display Line #4:	0.000 to 0.336 IN w.c.	(DIFFERENTIAL PRESSURE)

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT: **INTERMOUNTAIN POWER**

WORK ORDER: **50600** *REV:* **1**

TAG(S): **REAR OFA FEEDER DUCT (77" x 120")**

Given Information:

Fluid:	**AIR**		% H_2O (by volume)	
Standard Temperature (T_{std}):	**68**	(deg. F)	**0.00**	(%, by volume)
Standard Barometric Pressure (P_{std}):	**29.921**	(in. Hg)		
Air Temperature (T):	**750**	(deg. F)	Maximum Flow:	
Stack/Duct Pressure (P_g):	**0.00**	(in. w.c.)	**387,000**	(lb/hr)
Actual Barometric Pressure (P_{bar}):	**24.000**	(in. Hg)	**Wet**	(Wet/Dry)
Air Density at Standard Conditions, DRY:	**0.07513**	(lbs/ft^3)		
Duct Shape:	**RECT**		Square Root Extraction? (Yes/No)	
Duct Height:	**77.000**	(in.)	**Yes**	
Duct Width:	**120.000**	(in.)		
			Output:	
			4-20 mADC	

Calculations:

Duct Area (A_s):	64.167	(ft^2)
Maximum Actual Velocity:	3,823	(AFPM)
Absolute Duct Pressure (P_s):	24.000	(in. Hg)
Dry Mole Fraction of Duct (Mfd):	1.000	
Dry Molecular Wt. Of Air (Md):	28.965	(lb/lb-mole)
Wet Molecular Wt. Of Air (Ms):	28.965	(lb/lb-mole)
Air Density at Standard Conditions, WET:	0.07513	(lbs/ft^3)
Air Density at Actual Conditions, WET:	0.02630	(lbs/ft^3)

K-Factor: OFF

% FLOW (%)	Diff Press (in. w.c.)	Output (mADC)	Actual Flow (ACFM)	Std Flow/Dry (SCFM)	Std Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0.0000	4.00	00000				
10	0.0032	5.60	24,528	8,585	8,585	38,700	38,700
20	0.0128	7.20	49,055	17,170	17,170	77,400	77,400
30	0.0287	8.80	73,583	25,755	25,755	116,100	116,100
40	0.0510	10.40	98,111	34,340	34,340	154,800	154,800
50	0.0798	12.00	122,641	42,926	42,926	193,500	193,500
60	0.1149	13.60	147,169	51,511	51,511	232,200	232,200
70	0.1563	15.20	171,697	60,096	60,096	270,900	270,900
80	0.2042	16.80	196,224	68,681	68,681	309,600	309,600
90	0.2584	18.40	220,752	77,266	77,266	348,300	348,300
100	0.3191	20.00	245,280	85,851	85,851	387,000	387,000

Transmitter:	CAMM	Power (voltage/type):	24VAC
Flow Element:	VOLU-probe/SS w/Temp Probe	Power Configuration:	4-Wire
Transmitter Maximum Range:	0 - 387,000 LB/HR	Square Root:	ON
Temperature Range:	0 to 750°F	Density Compensation:	ON
Pressure Comp. Range:	24.00 to 32.00 in. Hg		

Temperature Sensor: 3-Pt. Type "E" T/C Probe with remote 4-20mADC temperature transmitter.

Display Line #1:	0 - 387,000 LB/HR	(FLOW)
Display Line #2:	0 to 750°F	(TEMPERATURE)
Display Line #3:	24.00 to 32.00 in. Hg	(ABSOLUTE PRESSURE)
Display Line #4:	0.000 to 0.319 IN w.c.	(DIFFERENTIAL PRESSURE)

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT **INTERMOUNTAIN POWER**
WORK ORDER **50600** *REV* **0**
TAG(S) **INDIVIDUAL OFA PORT (39.50" x 25.50")**

Given Information:

Fluid·	**AIR**		% H_2O (by volume)	
Standard Temperature (T_{std}):	**68**	(deg F)	**0.00**	(%, by volume)
Standard Barometric Pressure (P_{std})·	**29.921**	(in Hg)		
Air Temperature (T).	**665**	(deg F)	Maximum Flow:	
Stack/Duct Pressure (P_g).	**3.00**	(in w c)	**88,000**	(lb/hr)
Actual Barometric Pressure (P_{bar})·	**25.082**	(in Hg)	**Wet**	(Wet/Dry)
Air Density at Standard Conditions, DRY.	**0.07513**	(lbs/ft^3)		
Duct Shape:	**RECT**		Square Root Extraction? (Yes/No)	
Duct Height·	**39.500**	(in)	**Yes**	
Duct Width.	**25.500**	(in)		
			Output	
			4-20 mADC	

Calculations:

Duct Area (A_s):	6 995	(ft^2)
Maximum Actual Velocity:	7,032	(AFPM)
Absolute Duct Pressure (P_s)·	25 303	(in Hg)
Dry Mole Fraction of Duct (Mfd):	1 000	
Dry Molecular Wt Of Air (Md):	28 965	(lb/lb-mole)
Wet Molecular Wt Of Air (Ms)·	28 965	(lb/lb-mole)
Air Density at Standard Conditions, WET.	0 07513	(lbs/ft^3)
Air Density at Actual Conditions, WET.	0 02982	(lbs/ft^3)

K-Factor. OFF

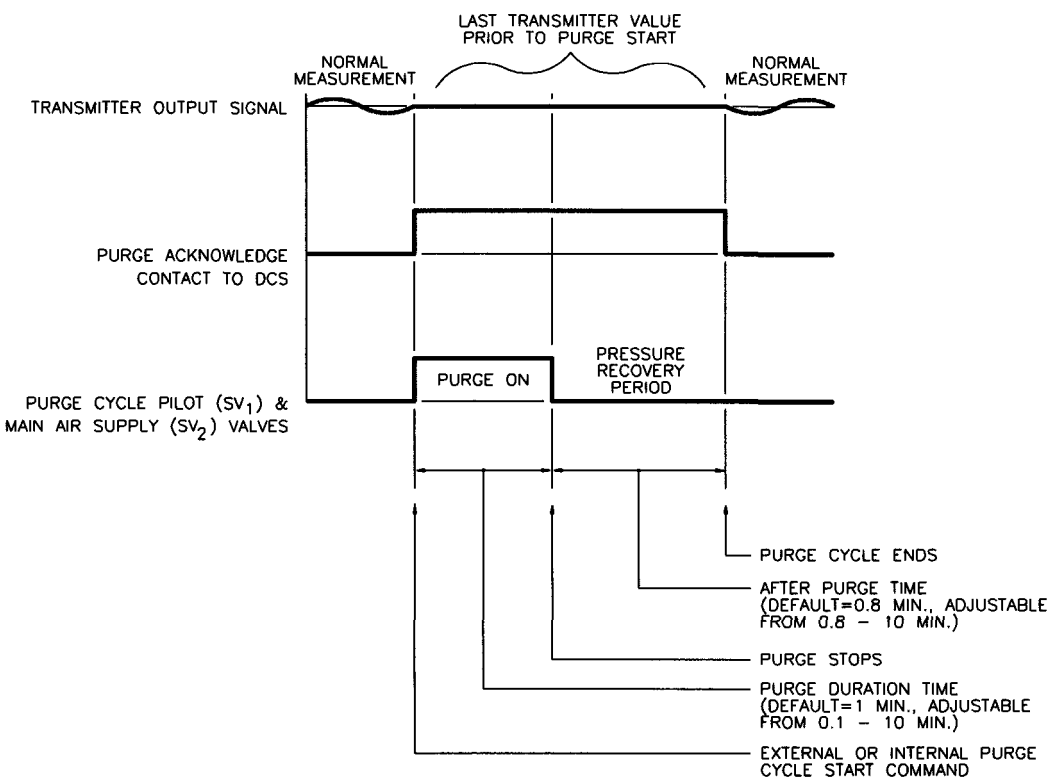
% FLOW (%)	Diff. Press. (in w c)	Output (mADC)	Actual Flow (ACFM)	Std.Flow/Dry (SCFM)	Std.Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0 0000	4 00	00000				
10	0 0122	5 60	4,918	1,952	1,952	8,800	8,800
20	0 0490	7 20	9,836	3,904	3,904	17,600	17,600
30	0 1102	8 80	14,757	5,857	5,857	26,400	26,400
40	0 1959	10 40	19,675	7,809	7,809	35,200	35,200
50	0 3061	12 00	24,594	9,761	9,761	44,000	44,000
60	0 4408	13 60	29,512	11,713	11,713	52,800	52,800
70	0 5999	15 20	34,430	13,665	13,665	61,600	61,600
80	0 7835	16 80	39,348	15,617	15,617	70,400	70,400
90	0 9917	18 40	44,269	17,570	17,570	79,200	79,200
100	1 2243	20 00	49,187	19,522	19,522	88,000	88,000

Transmitter:	(Not supplied by Air Monitor)	Power (voltage/type)·	N/A
Flow Element·	VOLU-probe/SS	Power Configuration	N/A
Transmitter Maximum Range:	N/A	Square Root:	ON

CAMM

PURGE CYCLE TIMING DIAGRAM

TIMING DIAGRAM



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SUB-B024, Rev 3 (10/97)

SUBMITTAL SHEET

CAMS
INSTALLATION GUIDE

Air Requirement.

80 to 125 psig at 100 CFM, oil and dirt free 1 to 24 purge cycles per day, with a field selectable duration between 30 and 120 seconds during which compressed air is released

Line Size from CAMS Panel to Flow Measuring Station or Probes.

Distance from CAMS panel to flow measuring station air probe.	Tube Size.
< 25'	1/2" S S tube
25' - 50'	3/4" S.S tube
> 50'	1 0" S S tube

Accumulator Tank (strongly recommended).
Requires coalescing filter, pressure regulator, and check valve at the tank inlet

120 gallons - All CA stations
120 gallons - Multiple VOLU-probes having a combined length greater than 10'
80 gallons - One or more VOLU-probes having a combined length less than 10'

Line from Accumulator Tank to CAMS Panel.

25' maximum length, ½" pipe (minimum) Recommend locating accumulator tank as close as possible to CAMS panel

Electrical Power Requirement.

- 24VAC, 54VA
- 24VDC, 48VA
- 120VAC, 108VA

Ambient Temperature.

40°F-140°F For ranges above or below this ambient temperature, use of panel heater and/or cooler is required

Purge Frequency.

Once/day minimum, once/hour maximum

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6 23 2

SUBMITTAL SHEET

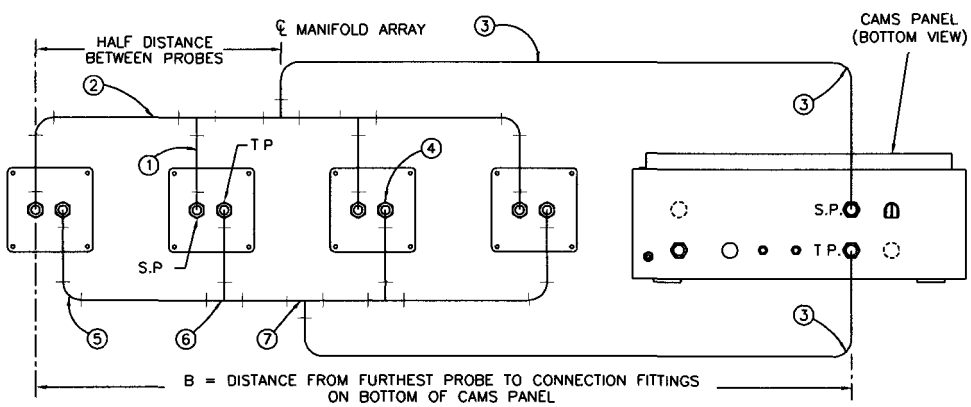
CAMS

TUBING REQUIREMENT FROM AIRFLOW MEASURING PROBES TO THE AUTO-purge PANEL

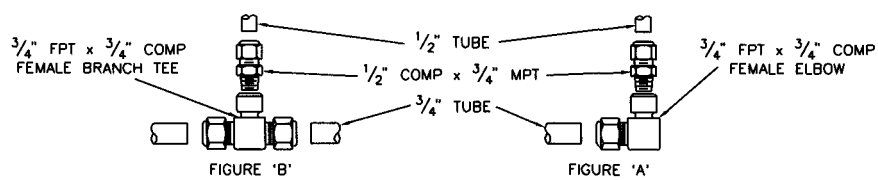
FUNCTION

This Submittal Sheet specifies the signal tubing sizes and fitting requirements from the connection fittings on the probes to the center of the manifolding arrays, and from the center of the manifolding arrays to the connection fittings on the bottom of the AUTO-purge Panel

TUBING LAYOUT



COMPONENT	IF LENGTH "B" IS 25 FEET OR LESS	IF LENGTH 'B' IS GREATER THAN 25 FEET
①	TUBE, ½" O.D. x .035 WALL	TUBE, ½" O.D x .035 WALL
②	TUBE, ½" O.D. x .035 WALL	TUBE, ¾" O.D x .035 WALL
③	TUBE, ½" O.D. x .035 WALL	TUBE, ¾" O.D. x .035 WALL
④	FITTING, ½" MPT x ½" COMP ELBOW	FITTING, ½" MPT x ½" COMP ELBOW
⑤	FITTING, ½" COMP ELBOW	SEE FIGURE 'A' BELOW
⑥	FITTING, ½" COMP TEE	SEE FIGURE 'B' BELOW
⑦	FITTING, ½" COMP TEE	FITTING, ¾" COMP TEE



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AIR MONITOR CORPORATION

6 24 2

IP7_027280

WARRANTY

PROCESS / POWER

PRODUCTS COVERED

AUTO-purge III **AUTO-purge/CEM** **CAMS**

WARRANTY

Air Monitor Corporation (hereinafter referred to as "Seller") warrants that at the time of shipment, products sold pursuant to this contract will be free from defects in materials and workmanship, and will conform to the specifications furnished or approved in writing by Seller. No warranty is given that delivered products will conform to catalog sheets, data sheets, and the like, which are subject to change without notice.

Seller will repair or replace, at its option, any products listed under this warranty which is returned freight pre-paid to Seller within the earlier of two (2) years after start-up or twenty-seven (27) months after shipment that, upon test and examination, proves defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period of the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as thermocouples, electrodes, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

Seller shall not be liable for any special or consequential damages or for loss of damage, directly or indirectly arising from the use of the products. Seller's warranty shall be limited to replacement of defective equipment and shall not include field removal and installation expenses.

The warranty set forth above is in lieu of all other warranties either express or implied and constitutes the full extent of Air Monitor Corporation's liability to the customer, or any other party for breach of warranty. THERE ARE NO EXPRESS WARRANTIES EXCEPT AS SET FORTH HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, WHICH ARE PARTICULARLY DISCLAIMED.

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AIR MONITOR CORPORATION

WARRANTY

PROCESS / POWER

PRODUCTS COVERED

FAN-E/SS	**VOLU-probe/SS**	**VOLU-probe/VS-SS**	**CA Stations**
LO-flo/SS	**VOLU-probe/SM**	**VOLU-probe/FI-SS**	**IBAMS**
SAP	**SOAP**	**STAT-probe/1SS**	**STACK-probe**

WARRANTY

Air Monitor Corporation (hereinafter referred to as "Seller") warrants that at the time of shipment, products sold pursuant to this contract will be free from defects in materials and workmanship, and will conform to the specifications furnished or approved in writing by Seller. No warranty is given that delivered products will conform to catalog sheets, data sheets, and the like, which are subject to change without notice.

Seller will repair or replace, at its option, any products listed under this warranty which is returned freight pre-paid to Seller within the earlier of one (1) year after start-up or fifteen (15) months after shipment that, upon test and examination, proves defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period of the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as thermocouples, electrodes, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

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AIR MONITOR CORPORATION

From: Garry Christensen
To: Howard Scott; Jerry Finlinson; Ken Nielson
Date: 2/23/2006 11:21 AM
Subject: Unit 2 NW over fire air flow indication

Howard, the NW overfire air flow indication went bad wednesday and is affecting the NOx limit calculation. The point ID is 2SGBFT0157. Would you get one of your tech's to look into it. Thanks for your help.

From: Jerry Finlinson
To: PUNCH
Date: 4/16/2006 12:55 PM
Subject: Overfired air flow pitot inspection
Attachments: OFA Engineering Inspection Report.wpd

4/14/06
Leak check on over fire air flow meter pitots in each corner of unit. Found major leaks in the controller cabinets that were tightened.

Inside the windbox every fitting where the T is connected to the pitot has a major air leak that needs welding repair. Weld 6 fittings on the pitots in each corner of the overfired air windbox, SE, SW, NE, NW.

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.

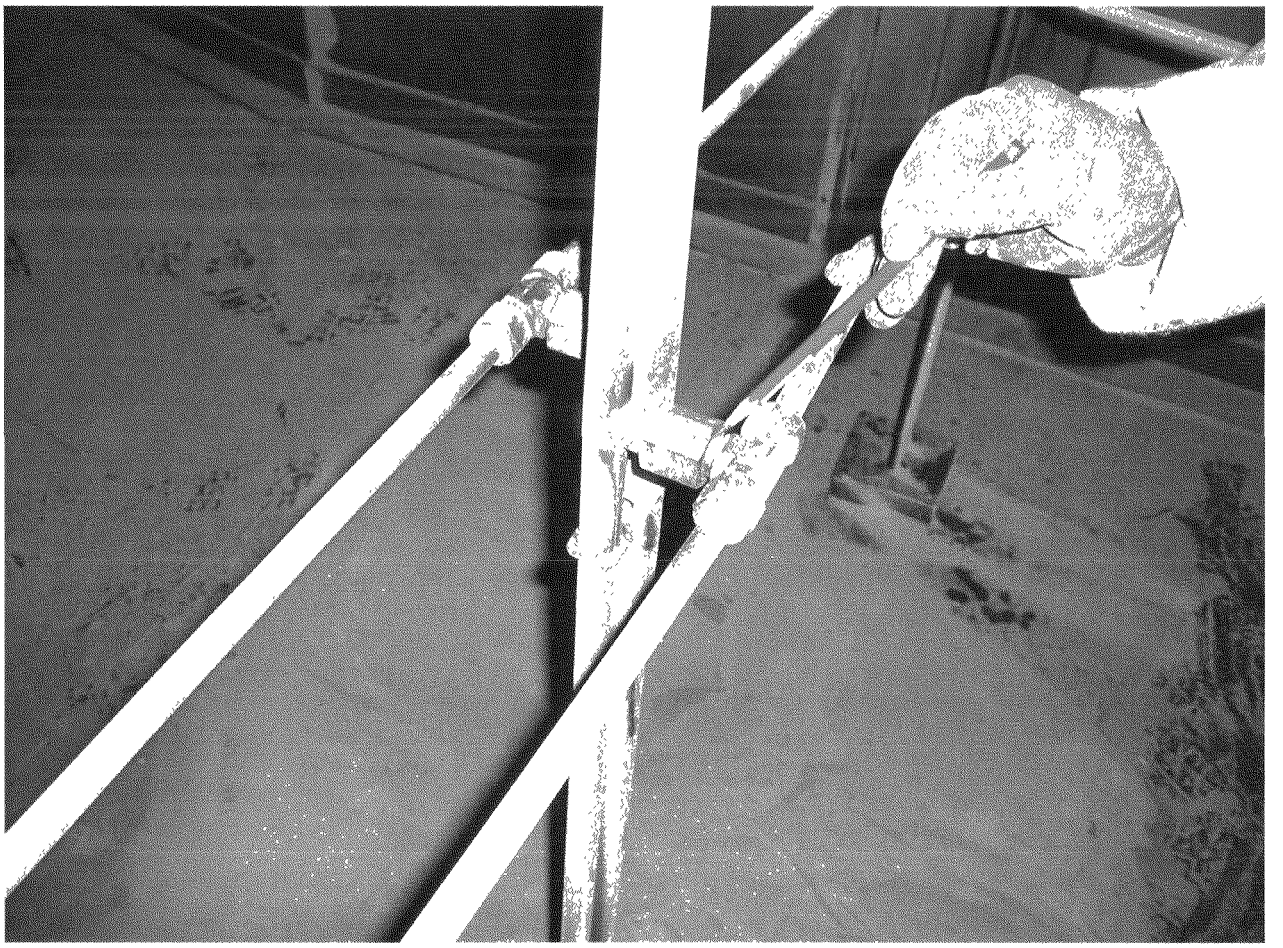
From: Jerry Finlinson
To: Ken Hall
Date: 4/17/2006 6:34 PM
Subject: IPSC Overfired Air pitots
Attachments: U2 OFA windbox fitting leaks 4-14-06 001.jpg; U2 OFA SE fitting weld repair 4-17-06 001.jpg; OFA Engineering Inspection Report.wpd

FYI,
Obviously you should be recommending that the overfired air fittings we welded in place. When we opened it up for inspection, every one of those fittings on the pitot tubes was leaking major gushers. The smaller fittings were galled on, so we couldn't take the fittings off to tighten. We simply welded the fittings in place. You should recommend they be installed with welding, because the tubing fittings cannot withstand the service temperatures.

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.



IP7_027286

IP7_027287

Engineering Services Inspection Report

INTERMOUNTAIN POWER SERVICE CORP.

System: 2SGA: Date: April 12,2006
Description: Over-Fire Air Windbox Inspection Page: 1 of 1
By: Garry Christensen

South Duct South duct had an accumulation of fly-ash. Guzzle out ash.

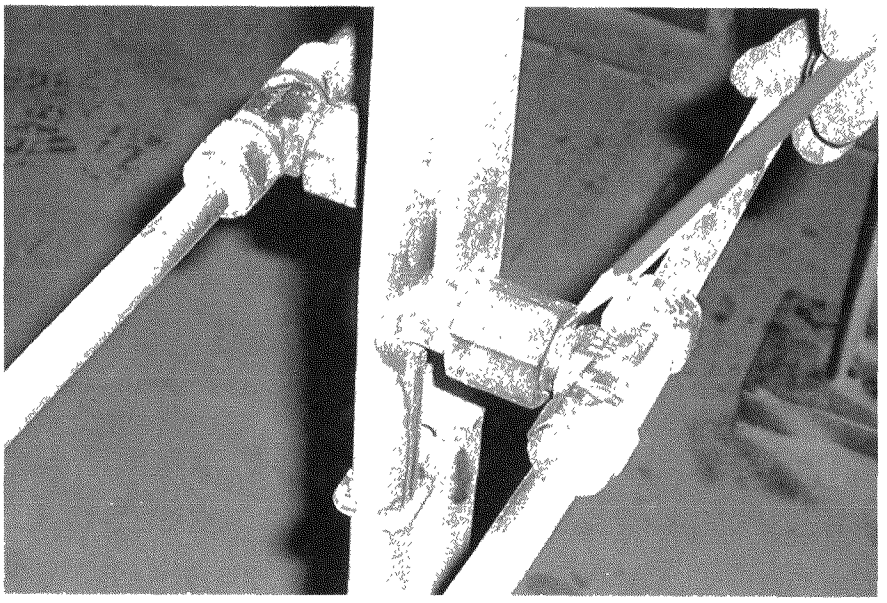
North Duct North duct has an accumulation of fly-ash. Guzzle out ash.

North-west inlet damper were found 100% open. The rest of the dampers were closed. Dampers (Both inlets as well as 1/3 and 2/3 dampers) need to be stroked when available.

4/14/06 Jerry Finlinson

Leak check on over fire air flow meter pitots in each corner of unit. Found major leaks in the controller cabinets that were tightened.

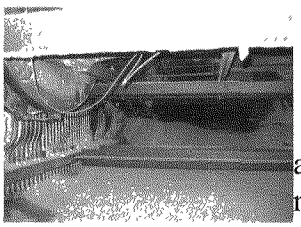
Inside the windbox every fitting where a T is connected to the pitot has a major air leak that needs welding repair. Weld 6 fittings on the pitots in each corner of the overfired air windbox, SE, SW, NE, NW.

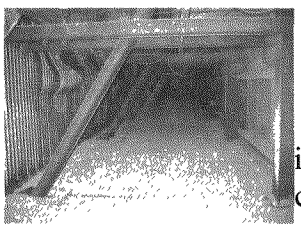


Engineering Services Inspection Report
INTERMOUNTAIN POWER SERVICE CORP

System: 1SGA: Steam Generator (windbox) Date: April 1-2, 2007
Description: Unit 1 Page: 1 of 3
By: Garry Christensen

D Row  Very little ash in windbox. All burner settings for CO with outer register mostly closed.

H Row A lot of  ash in windbox. All burner settings for CO with outer register mostly closed. Guzzle out ash.

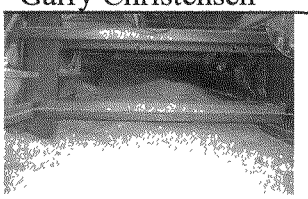
C Row Very little ash  in windbox. All burner settings for CO with outer register mostly closed.

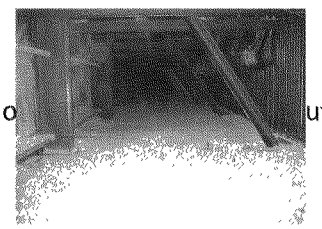
G Row Some ash in windbox. All burner settings for CO with outer register mostly closed. Guzzle out ash.

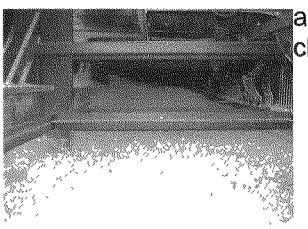
Engineering Services Inspection Report

INTERMOUNTAIN POWER SERVICE CORP.

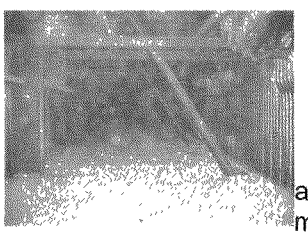
System: 1SGA: Steam Generator (windbox) Date: April 1-2, 2007
Description: Unit 1 Page: 2 of 3
By: Garry Christensen



E Row  Very little ash in windbox. All burner settings for CO with outer register mostly closed.

A Row Some ash in windbox. All burner settings for CO with outer register mostly closed.  Guzzle out ash.

F Row Very little ash in windbox. All burner settings for CO with outer register mostly closed.

B Row A lot of ash in windbox. B row has the most ash. Up to the burner on the  middle burners. All burner settings for CO with outer register mostly closed. Guzzle out ash.

General observations - The rope packing life around the burner outer register has about ended. The material is hard and is starting to breakup. Recommend replacing the packing the next planned outage.

Engineering Services Inspection Report

INTERMOUNTAIN POWER SERVICE CORP

System:	1SGA: Steam Generator (windbox)	Date:	April 1-2, 2007
Description:	Unit 1	Page:	3 of 3
By:	Garry Christensen		

The burners structurally are still sound with no signs of serious warpage.
The functionality of the registers is in question with many registers bound.

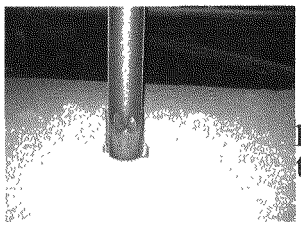
From: Garry Christensen
To: PUNCH
Date: 4/3/2007 7:51 AM
Subject: OFA duct and 9th floor under O2 probes
Attachments: OFA Inspection Report 4-2-07.wpd; 9th floor Inspection Report .wpd

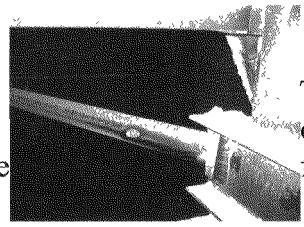
inspection reports found in
N:\current\outages\2007 Outages\U1 Major Outage April\Inspection Reports

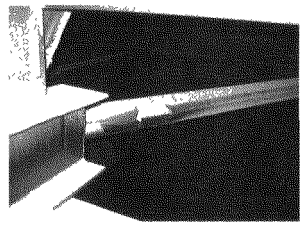
Engineering Services Inspection Report

INTERMOUNTAIN POWER SERVICE CORP.

System:	1SGA: Steam Generator (9th floor O2 probe area)	Date:	April 2, 2007
Description:	Unit 1	Page:	1 of 1
By:	Garry Christensen		





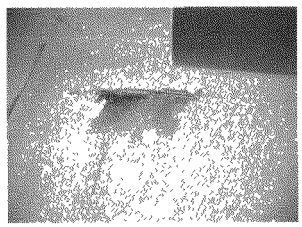


O2 probe area

The area under the O2 probe was inspected with the following observations.

Erosion on the guard rails above the air heaters in both east and west ducts.

Erosion on the pipe bracing in the west duct was found. One area was shielded during a previous outage. See photo. The crack on the floor near the center beam has increased.



example angle over support

Erosion in west duct

erosion

Crack in west duct floor

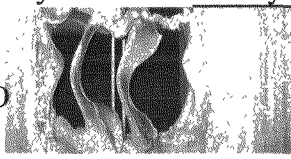
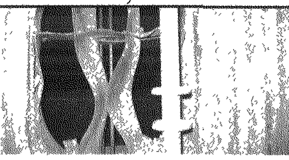
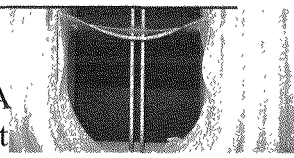
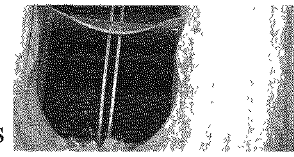
Clean flyash and patch hole in floor. Weld angle piece over erosion holes.

From: Garry Christensen
To: PUNCH
Date: 4/7/2007 1:07 PM
Subject: OFA fireside inspection
Attachments: OFA fireside Inspection Report .wpd

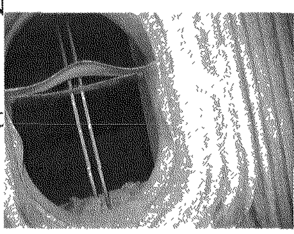
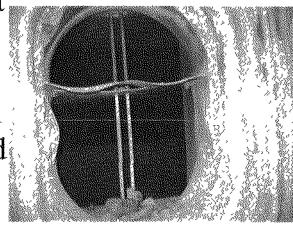
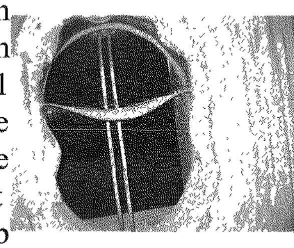
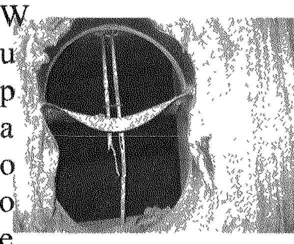
File has pictures so big file. Found at N:\outages\2007 outages\U1 Major Outage April\Inspection reports\Boiler\OFA fireside Inspection

Engineering Services Inspection Report
INTERMOUNTAIN POWER SERVICE CORP.

System:	1SGA: Steam generator (OFA fireside)	Date:	April 6, 2007
Description:	Unit 1	Page:	1 of 1
By:	Garry Christensen, Don Smith		

O  F o a  A rt nd 4 with heavy slag  s  P 3 b

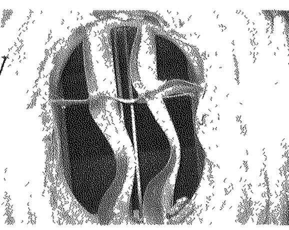
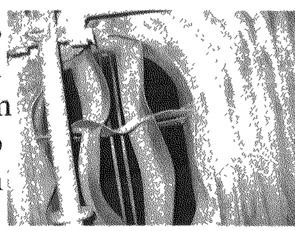
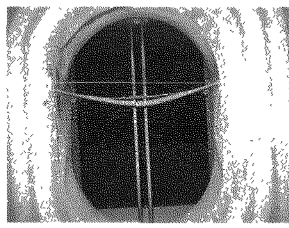
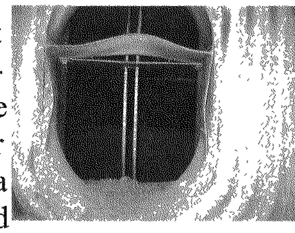
uildup on both front and rear walls with vanes overheating

N ll b rt t e u  ort - er on sid r m  h n 1 e e t b  W u p a o o e  a m o s v n r

8 port on the west side

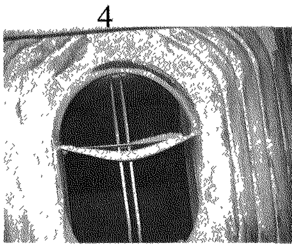
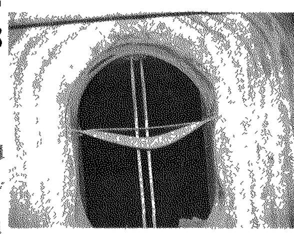
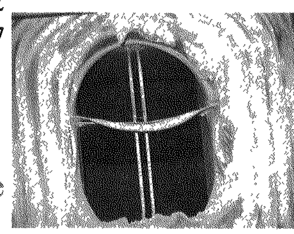
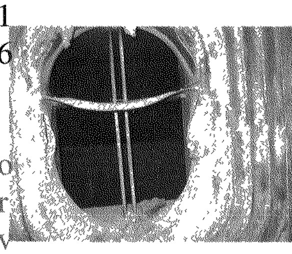
4 3 2 1

8 7 6 5

S W u 1 o t  o a m p n s  u ll b o e i  t - e r a d  h n r t s e

over to number 8 port on the west side

4 3 2 1

5 C t ic  8 u v a  7 t e l  6 o r v  u t a

nes on the 3rd and 4th ports on the front and rear wall.

IP7_027295

From: Jerry Finlinson
To: Jim Knapp
CC: John Fritzges
Date: 4/17/2007 6:34 AM
Subject: NW overfired air inlet damper

Jim,
Did you get the report that the NW overfired air inlet damper has a problem with the Jordan drive. Should we have Mark Cowley work on that as part of his OFA work order, or should we have someone else work on it? He thought the problem was with the drive, it starts oscillating midstroke.

Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.

From: John Fritzges
To: Finlinson, Jerry
Date: 4/17/2007 6:38 AM
Subject: Re: NW overfired air inlet damper

Jerry,
Mark will go back and check this one. He will likely have to remove the cover and go inside the drive to see what the problem is. It may be a feedback pot that is giving us the problem.

John

>>> Jerry Finlinson 4/17/2007 6:34 AM >>>
Jim,
Did you get the report that the NW overfired air inlet damper has a problem with the Jordan drive. Should we have Mark Cowley work on that as part of his OFA work order, or should we have someone else work on it? He thought the problem was with the drive, it starts oscillating midstroke.

Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.

From: Jerry Finlinson
To: Gary Dean
Date: 6/14/2007 1:38 PM
Subject: Air monitor OFA parameters.
Attachments: Air Mon CAMS params OFA.wpd

Gary,
Buried on my desk I found some updated parameters for Overfired air U2, which I edited into the file. Please replace the one in this folder:

S:\I&EDATA\AIR MONITOR\OVERFIRE AIR

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.

Air Monitor CAMS Setup Parameters
OVERFIRE AIR Updated 14 June 2007

U1 = Veltron IIB CPU board 4.40A 10601 800 Rev C
U2 = Veltron IIB CPU board 4.40A 10601 800 Rev D wo 50600

Serial Numbers: NE = B26913, NW = B26914, SE = B26915, SW = B26916.

1. Transmitter Scaling and Config

Process Config

Density Comp	-	ON
Density Comp Type	-	Mass
Temp/Press	-	Temp & Abs press
Process Type	-	Transmitter Flow
Process Units	-	Flow lb/hr
Process Format	-	Flow XXXX, X00 lb/hr
Process Minimum	-	Flow 00 lb/hr
Maximum	-	387,000 lbm/hr
Duct Area Units	-	Square Feet
Duct Area Range	-	0 - 325.00 sq/ft
Duct Area	-	SOUTH=59.17 sq/ft, NORTH=64.17
Temperature Units	-	° F =62.5
Barometric Pres Units	-	in. Hg
Output Lockdown	-	10.0% FS output
exit		

Temp Config

Input Linearization	-	OFF, NE = ON
Minimum Temperature	-	0° F
Maximum Temperature	-	750° F
Default Temp	-	665° F
Temp Fault Output	-	Default Temp
exit		

Absolute Pressure Config

Abs Press off/on	-	ON
Min Abs Pressure	-	24 in.Hg
Max Abs Pressure	-	32 in.Hg
exit		

Calculator for Max Flow

Calculate DP/Flow	-	Diff Press
Standard Temperature	-	68° F
Process Temperature	-	68° F
Static Pressure Units	-	in.WC
Process Static Press	-	0.0 in.WC
Bar Pres or Elevt'n	-	Barometric Pressure
Barometic Pressure	-	29.92 in.Hg - measurement
Wet/Dry Flow Basis	-	WET
Percentage Water	-	0.00%

Dry Molecular Weight - 28.966 lb/lb mole
Pitot Tube Coeffic- - 1.0
Calc Max Flow - 1,128,000 lb/hr
Calculate Diff Pres - SOUTH=0.13132 in.WC - measurement
NORTH=0.11166 in WC
Update Operating Span - NO
Reset Calc Default Values - NO
exit

Return to Main

2. Low Pass Filter Selection
   Low Pass filter - 6 - Needs more filtering as the signal is noisy and small.

3. Auto-Zero Config
   Auto-Zero Off/On Select - ON
   Auto-Zero Interval - 4HR

4. Auto-Purge Config
   Auto-Purge Off/On Select - ON
   Auto-Purge Activtn Select - INTERNAL ONLY
   Auto-Purge Interval - 23.65 hr = H

CORNER	PURGE INTERVAL
SW	8 HR
SE	8.05 HR
NE	8.15 HR
NW	8.10 HR

   Purge Duration - 1.0 Min
   After Purge Duration - 1.5 Min

5. Special Function Config
   Special Function Off/On - OFF
   Function Type - Summed Flow
   External Input Max - 00 lb/hr

6. K -Factor Config
   K-Factor Off/On - ON
   Calc K-Factor ? - NO
   Number of Data Points - One Pair
   Measured Point Selection - 1000 lb/hr
   Reference Point Selection - 1000 lb/hr
   K-Factor Gain - SW = 1.737, NE = 1.318, NW = 1.276, SE = 1.515
   K-Factor Bias - 0.0%

7. Enhanced Display Config
   - Line 1 - Filter 3
   - Line 2 - Parameter Temp
   - Line 3 - Parameter Abs Pres
   - Line 4 - Parameter Diff Press
   - Diff Pressure Units= in. Wc

8. Analog Output Config
   - Output 4 Selec - Transmitter DP

9. Transducer Span Selection -
   - Xdcr Natural Span 0.5 in.WC, sw = .3362, NE, NW = 0.319
   - Xdcr Operating Span - SOUTH=0.3753, NORTH=0.3191 in WC for 387,000 lbm/hr
   - (Calc from Mass Flow spreadsheet, set at highest temp and lowest pressure)

10. Transmitter Input Calib
    - Transducer Zero Calib - 0.00 in.WC
    - Transducer Span Calib - 0.5 in WC

11. Transmitter Ouput Calib
    - *Output 1 Zero* - *Perform Calib*
    - 1 Span - Perform Calib
    - 2 Zero - Perform Calib
    - 2 Span - Perform Calib
    - 3 Zero - Perform Calib
    - 3 Span - Perform Calib
    - 4 Zero - Perform Calib
    - 4 Span - Perform Calib

12. Xducr Characterization - depends on Xducer calib, values for U2.

SW	SE	NE	NW

DataPoint1

-

2721

0
0
0

Data Point 2	-	2,769	2,500	2,490	25010
Data Point 3	-	5,258	5.010	4,980	5010
Data Point 4	-	7,745	7,510	7,480	7,510
Data Point 5	-	10,238	10,050	9,990	10020

Note, these values are U1.

		Xducr Characterization						Xducr Characterization		
SW			Data 1	39		SE			Data 1	17
			Data 2	2,512					Data 2	2,492
			Data 3	4,981					Data 3	4,976
			Data 4	7,441					Data 4	7,474
			Data 5	9,913					Data 5	9,990
NE			Data 1	23		NW			Data 1	23
			Data 2	2,525					Data 2	2,502
			Data 3	5,040					Data 3	4,977
			Data 4	7,561					Data 4	7,488
			Data 5	10,103					Data 5	9,927

13. Display Internal Temp - 87° F - measurement
exit

From: Ken Nielson
To: PUNCH
Date: 10/31/2007 7:00 AM
Subject: OFA inspection report.
Attachments: 2007 U1 Short outage - OFA Damper & Linakge Inspection Report.wpd

INTERMOUNTAIN POWER SERVICE CORPORATION

Engineering Test and Inspection Sheet

Sheet 1 of 1

Equipment OFA LINKAGES & DAMPERS **Unit #** 1 **Test/Inspection Date** 10-30-07

Inspector KEN NIELSON **Responsible Engineer (Initials)** KMN

Item or Test	Observations/Comments	Recommendations
Visual inspection of all linkage bearings and welded connections. Visual inspection of linkage and damper travel and rotation.	Most bearings on through-wall linkage drive shafts & main linkage shafts are failed. Higher failure rate on north wall linkages. Bearings on dampers appeared largely intact. Rubs detected on north #7 (NW2/3)damper, south #2 (SE2/3) damper, and SE Inlet damper top blade north side. Bent all-thread connecting rod from NE1/3 damper drive to linkage (external to OFA duct. On NW 1/3 damper, connecting rod from drive to linkage reinforcing angle iron rubbing on adjacent piping. External to OFA duct. Photos taken.	Repair bent connecting rod on NE 1/3 damper drive. Grind rubbing damper blades to allow for clearance during travel/rotation. Brace piping away from NW 1/3 damper linkage. Schedule full bearing replacement for next major outage for all main and drive shaft bearings.

IP7_027304

From: Jerry Finlinson
Start: 10/1/2008
Due: 10/13/2008
Subject: Assisted operator to hang valve tags on 1&2CAB-BV-201-204 OFA Flowmeter Purge Isolation valves.

Created drawings 1&2 CAB-M2016K P&ID CONTROL AIR DETAILS - LVL 9

From: Garry Christensen
To: PUNCH
Date: 3/8/2009 10:54 AM
Subject: Unit 2 Burner Windbox and OFA inspection
Attachments: Windbox inspection and OFA.wpd; Garry Christensen.vcf

Attached is the inspection report with some pictures and the path. B windbox has a lot of ash accumulation and needs to be guzzled out. This windbox apparently was not guzzled out during the last major outage.

Garry Christensen
Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

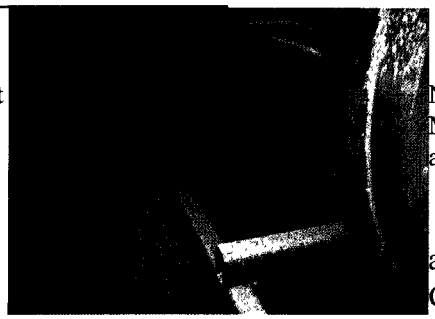
Engineering Services Inspection Report

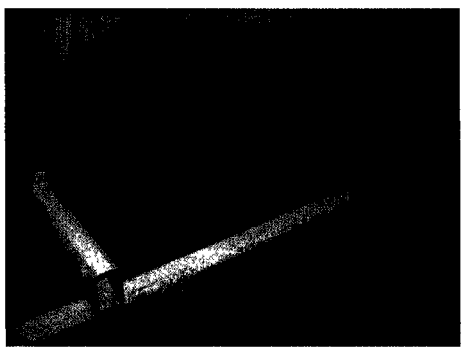
System:	2 SGA - Steam Generator	Date:	3-8-2009
Description:	Windbox	Page:	1 of 1
By:	Garry Christensen		

INTERIM

Pictures found at N:\current\outage\Minor Outage\2009\March 09\OFA Pics\ and windbox

Fly ash accumulation in B row - Guzzle out





Several cracks in the throat material were identified and will be checked during the next major overhaul on this unit.

OFA

Engineering Services Inspection Report

System:	2 SGA - Steam Generator	Date:	3-8-2009
Description:	Windbox	Page:	2 of 1
By:	Garry Christensen		

INTERMOUNTAIN POWER SERVICE CORP

Many of the ports were plugged off with slag accumulation. The slag was hammered off from inside the duct as well as washed off using the water cannon. The damper bearings inside the duct have overheated and should be replaced during the next major overhaul.

From: Jerry Finlinson
Start: 3/11/2009
Due: 3/11/2009
Subject: OFA snoop test with Dan Joseph. Only the NE had the door open.

Checked the rest on the outside only.

From: Garry Christensen
To: PUNCH
Date: 3/31/2009 3:14 PM
Subject: Over Fire Air Inspection/Punch list
Attachments: OFA Inspection Report 3-31-09.wpd; Garry Christensen.vcf

Report and pictures can also be found in N:\Current\OUTAGES\2009 Outages\U1 2009 MAJOR Outage April 09\Inspection Reports\Boiler\OFA

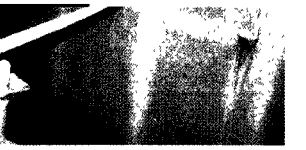
Garry Christensen
Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

Engineering Services Inspection Report

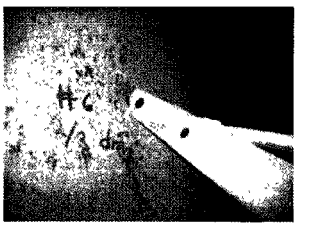
System:	1SGA: Steam Generator	Date:	March 31, 2009
Description:	Unit 1 Over Fire Air System	Page:	1 of 1
By:	Garry Christensen		

INTERMOUNTAIN POWER SERVICE CORP

Front Wall OFA Ducts numbered from east to west



Drive arm shaft on 2/3 damper on duct #4 bent.
Replace shaft piece.



Bent

drive arm shaft

Drive arm on 2/3 damper on duct #5 impacting the wall at 100%.
Trim piece to avoid contact.

Shaft

arm contacting wall

Fly ash in both ducts
Guzzle out both north and south ducts.

Replace bearings as time and material permits.

Typical worn bearing

From: "Matt Maragos" <mmaragos@airmonitor.com>
To: "'Jerry Finlinson'" <Jerry-F@ipsc.com>
CC: "'Bill Morgan'" <BILL-M@ipsc.com>, "'Howard Scott'" <HOWARD-S@ipsc.com>,...
Date: 4/6/2009 5:43 PM
Subject: RE: Air monitor pitot probe supports

Jerry,

We're not too worried about thermal expansion / contraction considering the debris that has accumulated between the socket end support and the probe. I understand it won't wiggle, so axial movement is limited - but the socket and probe are both stainless so their thermal coefficients are the same. We don't know if it will ride up and down (impossible to know without removing the probe since it is fixed to the top of the duct), but again, we are not concerned about this. Many applications are fixed with an end support stud and little to no room to move.

We don't believe it is necessary to clean the socket out.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 3:32 PM
To: 'Janet Bauman'; Matt Maragos; 'Ken Hall'
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: RE: Air monitor pitot probe supports

Matt,
We have a question about our primary air pitots. They are inserted from
the top of the duct and go through some holes in the bottom of the duct with a cleanout cap. We noticed on a few mills and particularly E mill. That the hole in the bottom was stuffed with rocks and the pitots won't wiggle.
This might be bad because it could put stress on the pitot when the duct expands and
crack or bend the pitot.

Last year we had a broken pitot and when we were trying to take it off the bolts broke on the mounting plate. We are reluctant to try taking the plate off the bottom because of potential breakage.

In you opinion, how serious is it that the pitot is jammed up tight and won't
wiggle. Should we put major effort into cleaning that out?
see the attached photo.

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

There's always more to do than you can do. Prioritize!

>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/2/2008 4:18 PM >>>
Jerry,

First complaint on the companion mounting plates that we have received, but keep in mind that most probes are never removed from the duct.

We'll get a couple new plates out to you ASAP (no charge), but they will have small diameter bolts. That's all we have in stock.

In retrospect (hindsight is always 20:20), it may have been better to provide extended companion mounting plates on this project that would have cleared the duct insulation. This may have cut back on the corrosion and would have made probe removal possible without pulling back the insulation. Also, in the event of bolt failure, there would have been access to both sides of the mounting plate, making replacement of the bolts easier.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Wednesday, April 02, 2008 2:30 PM
To: Janet Bauman; Matt Maragos; Ken Hall
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: Air monitor pitot probe supports

FYI,
I've got some negative feedback on the design of your air monitor pitot supports.
The bolts are too small of diameter. I asked the tech to take the removable caps off
the bottom of the B mill duct to check for dust in the bottom of the probe.
On several of them the 1/4 inch studs broke off while trying to remove the nuts.
So we only got one off successfully. It was OK with not much dust in the bottom of the
probe.

Since we have one broken pitot probe, we removed it from the duct so that we could do
a weld repair in the shop. The 1/4 inch bolts are all rusty and all 4 of those broke off even

after soaking overnight with Kroil.

So now we need to do some kind of bolt repair so that we can mount the pitot back.
I suppose we could order another plate with bolts that could be cut off and rewelded on.

I really think you should have a larger bolt diameter and use some bolts that could
handle the environment and still be able to get the nuts off a few years later.

What is your other experience with those bolts?
Do you have any good suggestions about how to get the nuts off without breaking the bolts?

How much would a new bolt plate cost?
Is that something you stock that we could get in a timely manner?

Thanks,

Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com
What's the best thing you could be working on, and why aren't you? Richard Hamming

From: Jerry Finlinson
To: Matt Maragos
CC: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson
Date: 4/6/2009 6:10 PM
Subject: Air monitor Overfired air pitot guide tube question
Attachments: U1 OFA NW pitot bent 2 sm.jpg; U1 OFA NW pitot bent 1 sm.jpg; U1 OFA NW pitot bent 3 sm.jpg; 51157 R1 As Installed Submittal 3-24-04.pdf

Matt,
Thanks for the response. That leads me to another question.
In our Overfired air ducts we have some longer probes. In unit 1, the guide cylinder was installed on the bottom of the duct, instead of the top and now they are packed with flyash. As a results the pitots in the north west duct are bending. We have some options.

1) We could cut out all the pitots and tubing inside the duct, turn them upside down and reinstall with the guide cylinders on the top. However, that would be a lot of welding work and require a recalibration.

2) We are considering drilling a hole in the front and back of the guide cylinder close to the floor, which would allow the flyash to be poked out or even come out on it's own. We wonder how close to the duct floor the pitot is inside the guide cylinder. see attached photos.

According to the original submittal, the probes are only 1/4 inch shorter than the duct heights of 75 inches and 77 inches.

What is your advise?

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

There's always more to do than you can do. Prioritize!

>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/6/2009 5:41 PM >>>
Jerry,

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and probe are both stainless so their thermal coefficients are the same. We don't know if it will ride up and down (impossible to know without removing the probe since it is fixed to the top of the duct), but again, we are not concerned about this. Many applications are fixed with an end support stud and little to no room to move.

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see the attached photo.

Thanks, Jerry

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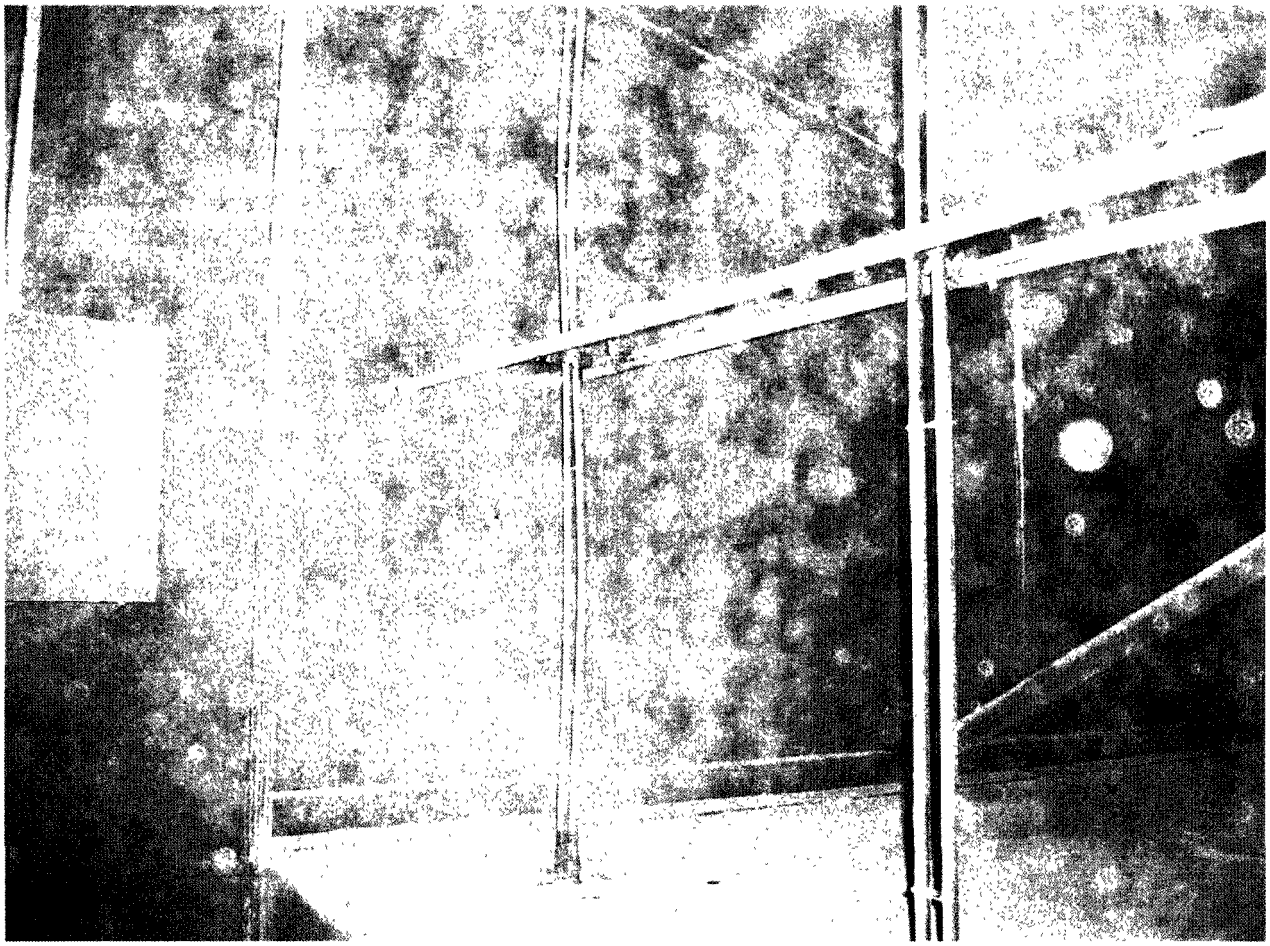

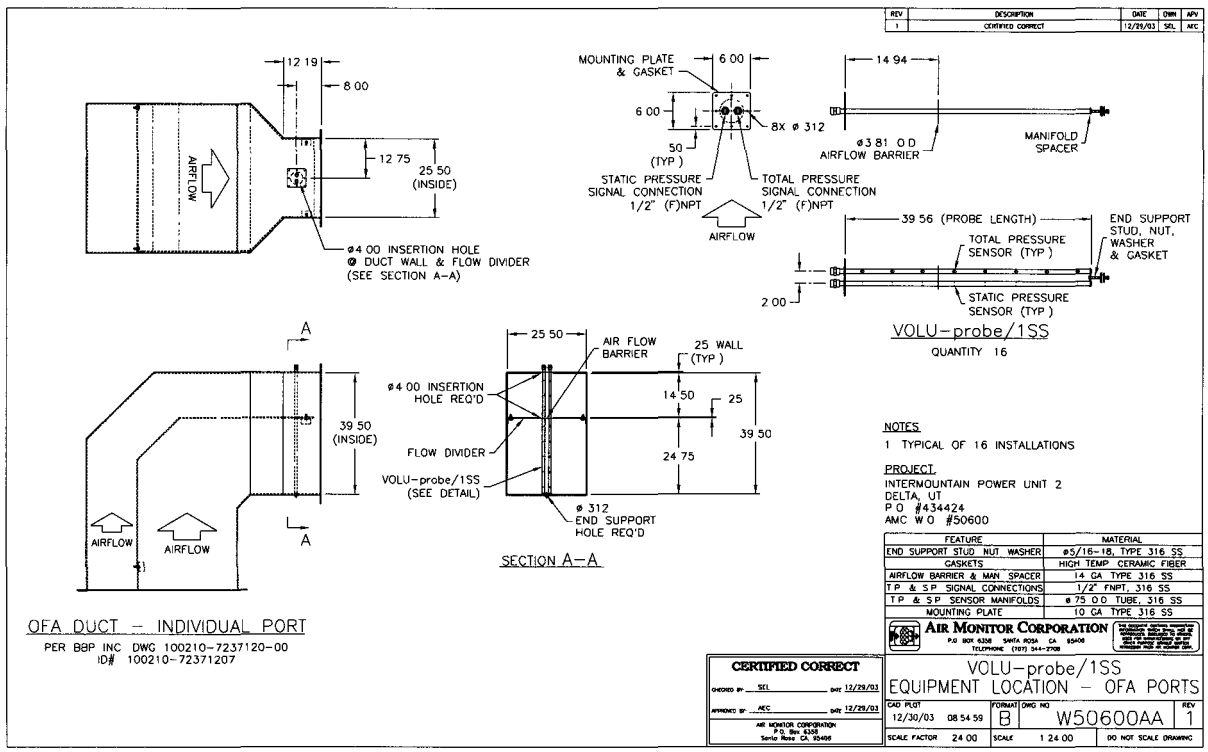
REV
DESCRIPTION
DATE
DWN
APV
1
CERTIFIED CORRECT
12/29/03
SEL
AEC
12 19
8 00
AIRFLOW
12 75
25 50
(INSIDE)
ø4 00 INSERTION HOLE
Ø DUCT WALL & FLOW DIVIDER
(SEE SECTION A-A)
MOUNTING PLATE
& GASKET
6 00
6 00
8X ø 312
50
(TYP)
STATIC PRESSURE
SIGNAL CONNECTION
1/2" (F)NPT
TOTAL PRESSURE
SIGNAL CONNECTION
1/2" (F)NPT
AIRFLOW
14 94
ø3 81 O D
AIRFLOW BARRIER
MANIFOLD
SPACER
39 56 (PROBE LENGTH)
END SUPPORT
STUD, NUT,
WASHER
& GASKET
TOTAL PRESSURE
SENSOR (TYP)
2 00
STATIC PRESSURE
SENSOR (TYP)
VOLU-probe/1SS
QUANTITY 16
A
39 50
(INSIDE)
AIRFLOW
AIRFLOW
A
25 50
AIR FLOW
BARRIER
25 WALL
(TYP)
ø4 00 INSERTION
HOLE REQ'D
14 50
25
39 50
FLOW DIVIDER
24 75
VOLU-probe/1SS
(SEE DETAIL)
ø 312
END SUPPORT
HOLE REQ'D
SECTION A-A
OFA DUCT - INDIVIDUAL PORT
PER B&P INC DWG 100210-7237120-00
ID# 100210-72371207
NOTES
1 TYPICAL OF 16 INSTALLATIONS
PROJECT
INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600
FEATURE
MATERIAL
END SUPPORT STUD NUT WASHER
ø5/16-18, TYPE 316 SS
GASKETS
HIGH TEMP CERAMIC FIBER
AIRFLOW BARRIER & MAN SPACER
14 GA TYPE 316 SS
T P & S P SIGNAL CONNECTIONS
1/2" FNPT, 316 SS
T P & S P SENSOR MANIFOLDS
ø 75 O D TUBE, 316 SS
MOUNTING PLATE
10 GA TYPE 316 SS
AIR MONITOR CORPORATION
P.O. BOX 6358 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706
CERTIFIED CORRECT
CHECKED BY: SEL DATE 12/29/03
APPROVED BY: AEC DATE 12/29/03
AIR MONITOR CORPORATION
P.O. Box 6358
Santa Rosa, CA. 95406
VOLU-probe/1SS
EQUIPMENT LOCATION - OFA PORTS
CAD PLOT
12/30/03 08 54 59
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DWG NO
W50600AA
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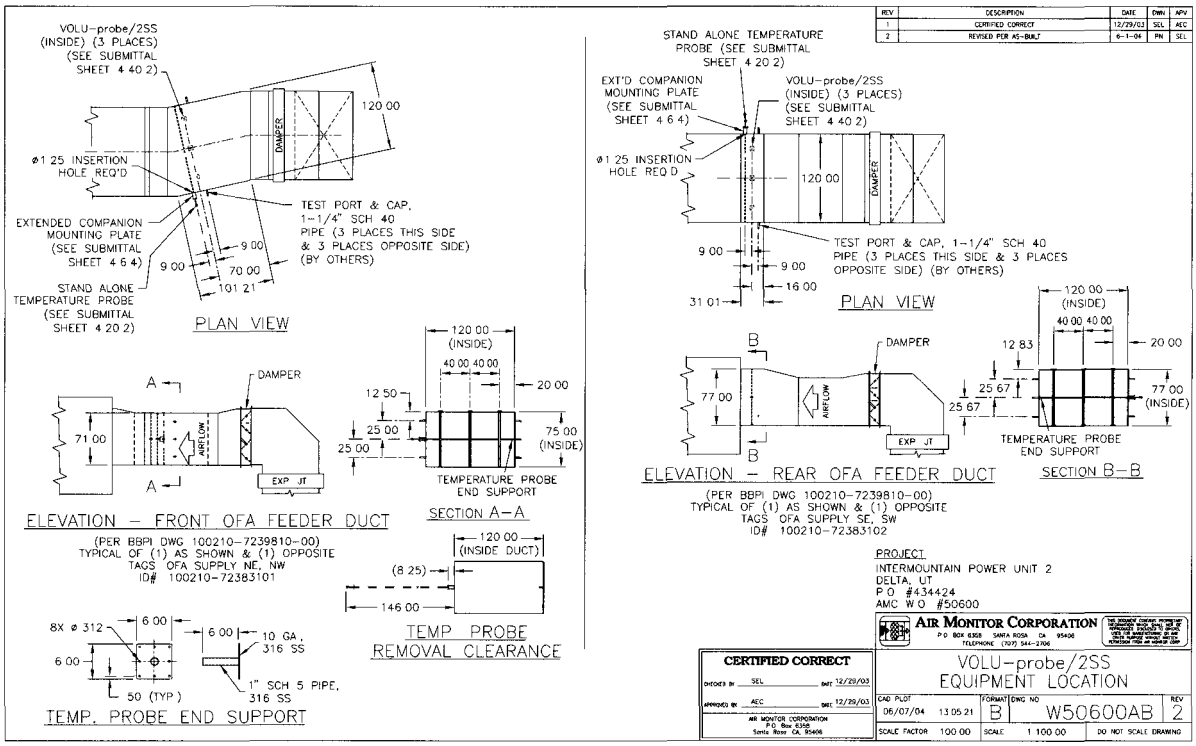
SCALE 1 24 00
DO NOT SCALE DRAWING

IP7_027318


VOLU-probe/2SS (INSIDE) (3 PLACES) (SEE SUBMITTAL SHEET 4 40 2)
120 00
DAMPER
ø1 25 INSERTION HOLE REQ'D
TEST PORT & CAP, 1-1/4" SCH 40 PIPE (3 PLACES THIS SIDE & 3 PLACES OPPOSITE SIDE) (BY OTHERS)
EXTENDED COMPANION MOUNTING PLATE (SEE SUBMITTAL SHEET 4 6 4)
9 00
9 00
70 00
101 21
STAND ALONE TEMPERATURE PROBE (SEE SUBMITTAL SHEET 4 20 2)
PLAN VIEW
A
DAMPER
71 00
AIRFLOW
EXP JT
A
ELEVATION - FRONT OFA FEEDER DUCT
(PER BBPI DWG 100210-7239810-00) TYPICAL OF (1) AS SHOWN & (1) OPPOSITE TAGS OFA SUPPLY NE, NW ID# 100210-72383101
120 00 (INSIDE)
40 00 40 00
20 00
12 50
25 00
25 00
75 00 (INSIDE)
TEMPERATURE PROBE END SUPPORT
SECTION A-A
8X ø 312
6 00
6 00
6 00
10 GA., 316 SS
1" SCH 5 PIPE, 316 SS
50 (TYP)
TEMP. PROBE END SUPPORT
120 00 (INSIDE DUCT)
(8 25)
146 00
TEMP PROBE REMOVAL CLEARANCE
STAND ALONE TEMPERATURE PROBE (SEE SUBMITTAL SHEET 4 20 2)
EXT'D COMPANION MOUNTING PLATE (SEE SUBMITTAL SHEET 4 6 4)
VOLU-probe/2SS (INSIDE) (3 PLACES) (SEE SUBMITTAL SHEET 4 40 2)
ø1 25 INSERTION HOLE REQ'D
120 00
DAMPER
TEST PORT & CAP, 1-1/4" SCH 40 PIPE (3 PLACES THIS SIDE & 3 PLACES OPPOSITE SIDE) (BY OTHERS)
9 00
9 00
16 00
31 01
PLAN VIEW
B
DAMPER
77 00
AIRFLOW
EXP JT
B
ELEVATION - REAR OFA FEEDER DUCT
(PER BBPI DWG 100210-7239810-00) TYPICAL OF (1) AS SHOWN & (1) OPPOSITE TAGS OFA SUPPLY SE, SW ID# 100210-72383102
120 00 (INSIDE)
40 00 40 00
20 00
12 83
25 67
25 67
77 00 (INSIDE)
TEMPERATURE PROBE END SUPPORT
SECTION B-B
REV DESCRIPTION DATE DWN APV
1 CERTIFIED CORRECT 12/29/03 SEL AEC
2 REVISED PER AS-BUILT 6-1-04 PN SEL
PROJECT
INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600
AIR MONITOR CORPORATION
P O BOX 8368 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706
CERTIFIED CORRECT
CHECKED BY SEL DATE 12/29/03
APPROVED BY AEC DATE 12/29/03
AIR MONITOR CORPORATION P.O. Box 8368 Santa Rosa, CA. 95406
VOLU-probe/2SS EQUIPMENT LOCATION
CAD PLOT 06/07/04 13 05 21
FORMAT B
DWG NO W50600AB
REV 2
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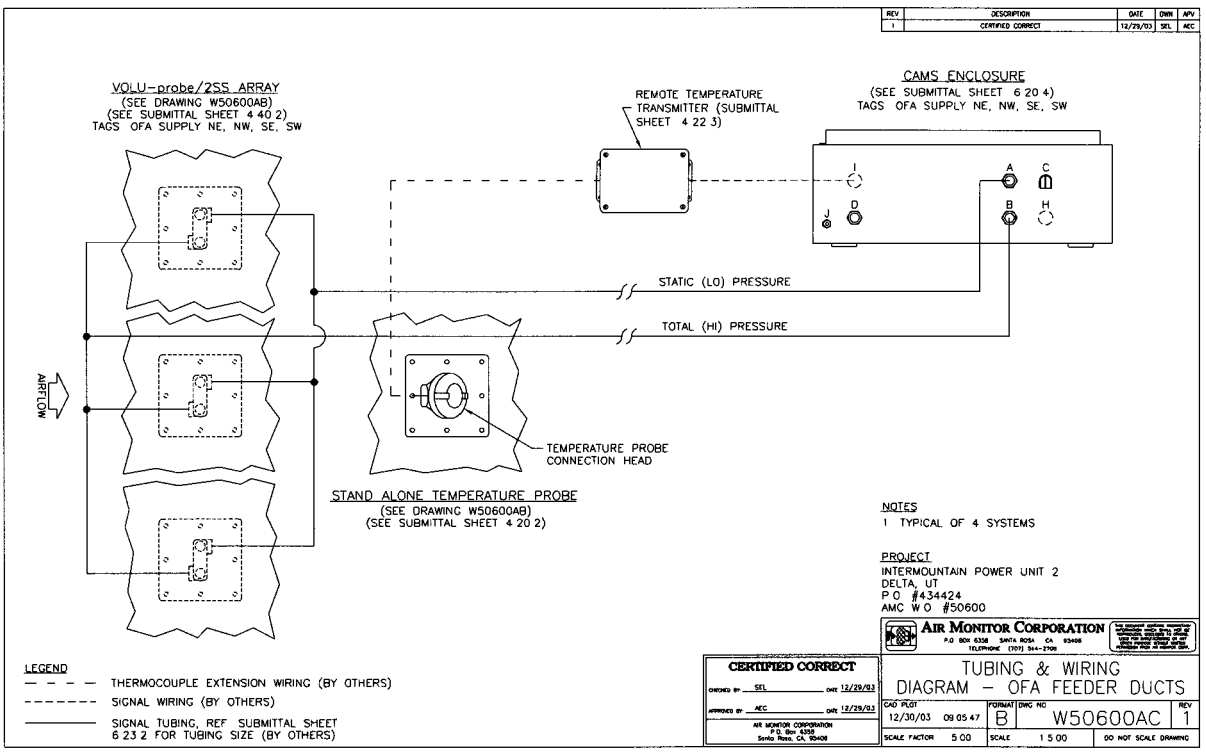
SCALE 1 100 00
DO NOT SCALE DRAWING

IP7_027319


REV
DESCRIPTION
DATE
DWN
APV
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CERTIFIED CORRECT
12/29/03
SEL
AEC
VOLU-probe/2SS ARRAY
(SEE DRAWING W50600AB)
(SEE SUBMITTAL SHEET 4 40 2)
TAGS OFA SUPPLY NE, NW, SE, SW
REMOTE TEMPERATURE TRANSMITTER (SUBMITTAL SHEET 4 22 3)
CAMS ENCLOSURE
(SEE SUBMITTAL SHEET 6 20 4)
TAGS OFA SUPPLY NE, NW, SE, SW
J
A
C
D
B
H
STATIC (LO) PRESSURE
TOTAL (HI) PRESSURE
AIRFLOW
TEMPERATURE PROBE CONNECTION HEAD
STAND ALONE TEMPERATURE PROBE
(SEE DRAWING W50600AB)
(SEE SUBMITTAL SHEET 4 20 2)
NOTES
1 TYPICAL OF 4 SYSTEMS
PROJECT
INTERMOUNTAIN POWER UNIT 2
DELTA, UT
P O #434424
AMC W O #50600
AIR MONITOR CORPORATION
P.O BOX 6338 SANTA ROSA CA 95406
TELEPHONE (707) 544-2706
LEGEND
THERMOCOUPLE EXTENSION WIRING (BY OTHERS)
SIGNAL WIRING (BY OTHERS)
SIGNAL TUBING, REF SUBMITTAL SHEET 6 23 2 FOR TUBING SIZE (BY OTHERS)
CERTIFIED CORRECT
CHECKED BY SEL DATE 12/29/03
APPROVED BY AEC DATE 12/29/03
AIR MONITOR CORPORATION
P.O. Box 6338
Santa Rosa, CA. 95406
TUBING & WIRING
DIAGRAM – OFA FEEDER DUCTS
CAD PLOT
12/30/03 09 05 47
FORMAT
B
DWG NO
W50600AC
REV
1
SCALE FACTOR 5 00
SCALE 1 5 00
DO NOT SCALE DRAWING

IP7_027320

SUBMITTAL SHEET

VOLU-probe / 1SS – INDUSTRIAL
EXTERNALLY MOUNTED
STAINLESS STEEL AIRFLOW TRAVERSE PROBE

STANDARD CONSTRUCTION

Probe.	½", ¾", or 1" tube sensing manifolds, threaded end support, washer and nut, mounting plate, signal connection fittings, and identification tag, all fabricated of Type 316 stainless steel Neoprene gaskets included
Mounting.	External duct mounted Threaded end support for probes greater than 18" long
Connection Fittings.	½" FPT stainless steel
Operating Temperature.	Continuous operation to 900°F

PERFORMANCE SPECIFICATIONS

Accuracy.	2-3%, dependent upon quantity and placement of probes to achieve traverse of ducted airflow
Outputs.	Individually averaged signals of total and static pressure
Operating Velocity.	100-10,000 FPM
Directional Sensitivity.	Not measurably affected by directional airflows and pitch and yaw angles up to 30°
Traverse Pattern.	On an equal area basis for rectangular probes On an equal concentric area basis for circular probes
Resistance.	Less than 0 1 times the velocity pressure head at probe operating velocity

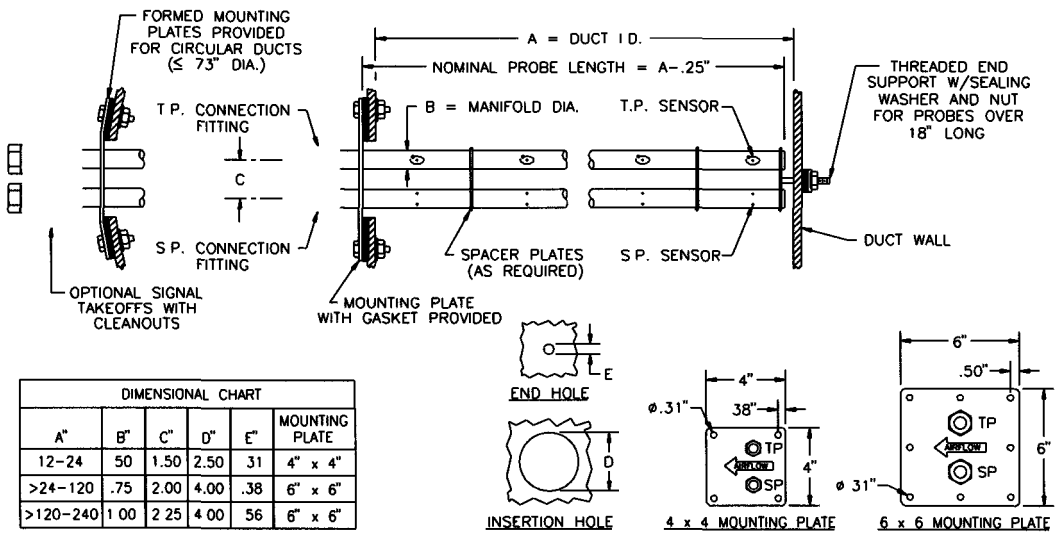
OPTIONAL CONSTRUCTION

Connection Fitting.
- ❑ ¼" Compression
- ❑ ½" Compression

Signal Connection.
- ❑ Cleanout

High Temperature Gaskets.
- ❑ Silicone, for continuous operation between 200°F and 400°F
- ❑ Fiber, for continuous operation between 400°F and 900°F

DIMENSIONAL SPECIFICATIONS



DIMENSIONAL CHART					
A"	B"	C"	D"	E"	MOUNTING PLATE
12-24	50	1.50	2.50	31	4" x 4"
>24-120	.75	2.00	4.00	.38	6" x 6"
>120-240	1 00	2 25	4 00	56	6" x 6"

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4.36.2

SUBMITTAL SHEET

VOLU-probe / 2SS – INDUSTRIAL
INTERNALLY MOUNTED
STAINLESS STEEL AIRFLOW TRAVERSE PROBE

STANDARD CONSTRUCTION

Probe.	½", ¾" or 1" tube sensing manifolds, mounting plates, signal connection fittings, and identification tag, all fabricated of Type 316 stainless steel
Mounting.	Internal duct mounted Dual end mounting plates
Connection Fittings.	½" FPT stainless steel
Operating Temperature.	Continuous operation to 900°F

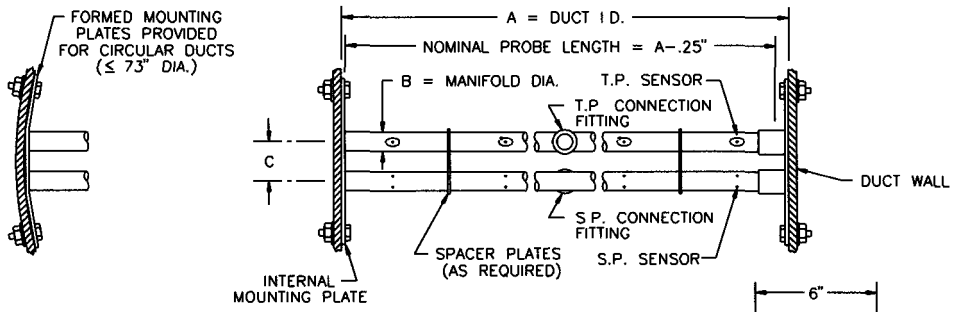
PERFORMANCE SPECIFICATIONS

Accuracy.	2-3%, dependent upon quantity and placement of probes to achieve traverse of ducted airflow
Outputs.	Individually averaged signals of total and static pressure
Operating Velocity.	100-10,000 FPM
Directional Sensitivity.	Not measurably affected by directional airflows with pitch and yaw angles up to 30°
Traverse Pattern.	On an equal area basis for rectangular probes On an equal concentric area basis for circular probes
Resistance.	Less than 0 1 times the velocity pressure head at probe operating velocity

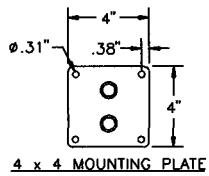
CONNECTION FITTINGS .

- ❑ ¼" Compression
- ❑ ½" Compression

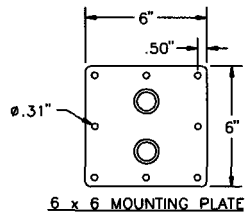
DIMENSIONAL SPECIFICATIONS



DIMENSIONAL CHART			
A"	B"	C"	MOUNTING PLATE
12~24	50	1.50	4" x 4"
>24~120	.75	2 00	6" x 6"
>120~240	1.00	2 25	6" x 6"



4 x 4 MOUNTING PLATE



6 x 6 MOUNTING PLATE

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SUBMITTAL SHEET

VOLU-probe, VOLU-probe/SS, & VOLU-probe/VS
MINIMUM INSTALLATION REQUIREMENTS

INSTALLATION CONSIDERATIONS Installation factors to be considered when applying the VOLU-probe are as follows

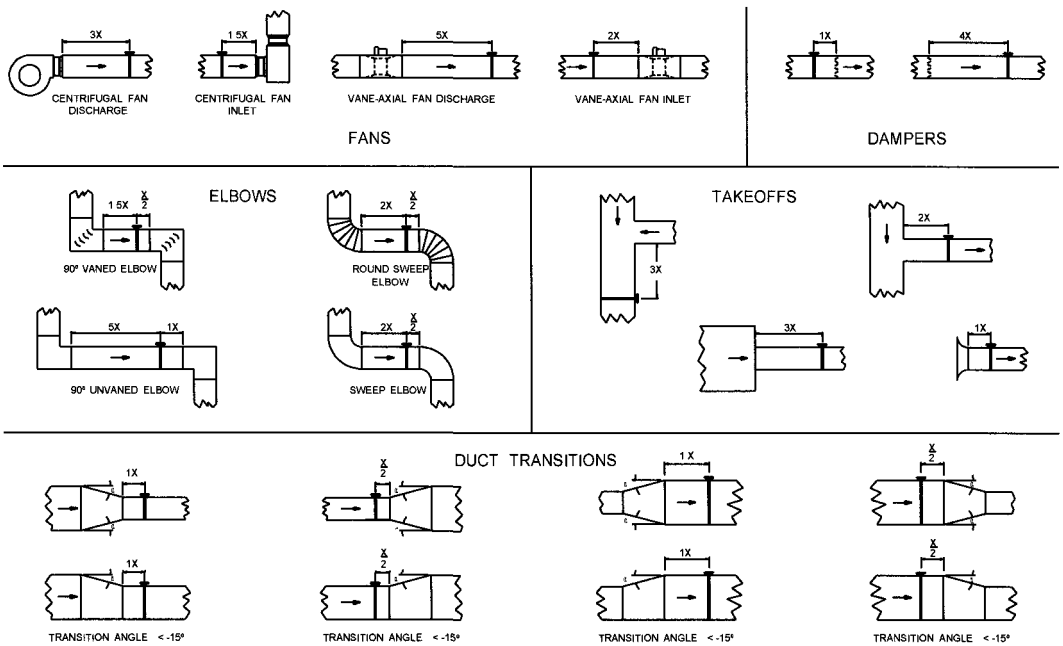
Turbulent Airflow. The unique design of the total and static pressure sensors of the VOLU-probe will permit accurate flow measurement in the presence of moderate air turbulence The distances from air turbulence producing fittings, transitions, etc , shown below in the Minimum Requirements for Installation, are required to assure accurate VOLU-probe operation

Stratified Airflow. The VOLU-probe should be mounted so that the probe crosses any stratified airflow - not parallel to the flow This mounting arrangement will permit the probe to sense the wide range of velocity profiles present in a stratified airflow

Airborne Contaminants. The levels of air filtration and cleanliness associated with commercial HVAC Systems, whether supply/return/exhaust/outside air, are satisfactory for operation of the VOLU-probe Industrial applications containing airborne contaminants may require periodic manual or automatic cleaning using compressed air applied to the signal fittings, and/or removal from the duct or stack for physical cleaning

Direction of Airflow. The VOLU-probe will function only with the probe mounted so that the total pressure sensor holes are directed into the approaching airstream To prevent improper installation, each VOLU-probe is marked with an arrow indicating the required direction of airflow

MINIMUM REQUIREMENTS FOR INSTALLATION Note: VOLU-probe locations shown are NOT ideal They indicate the minimum clearance required from air turbulence producing sources. Wherever possible, the VOLU-probe should be installed where greater runs of straight duct (or clearances) than shown exist



Rectangular Duct $x = \frac{2(H \times W)}{H + W}$ Circular Duct x = Duct Diameter

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4 23.2

IP7_027323

SUBMITTAL SHEET

TEMPERATURE PROBE
SINGLE POINT
SELF-SUPPORTED

NOTE: USE COMPANION MOUNTING PLATE TO MOUNT TEMPERATURE PROBE ASSEMBLY SEE SUBMITTAL SHEET 4.6.4

STANDARD CONSTRUCTION

Temperature Element.	100 ohm platinum RTD or Thermocouple
Temperature Element Sheathing.	¼" diameter RTD or ½" diameter Thermocouple, 316 stainless steel
Temperature J-Box.	NEMA 4 cast aluminum
Temperature Transmitter.	2-wire, 4-20mA non-isolated, linearized output (24 to 40VDC loop power required)
Mounting Plate.	6" x 6", 316 stainless steel
Support Tube.	316 stainless steel

PERFORMANCE SPECIFICATIONS

RTD Element Accuracy.	± 1 Ω @ °C, per SAMA RC21-4-1966
Thermocouple Accuracy.	Per ANSI Circular MC 96 1-1982
RTD Temperature Coefficient (Alpha).	0.00385
Temperature Transmitter Range.	0 to 750°F

OPTIONS

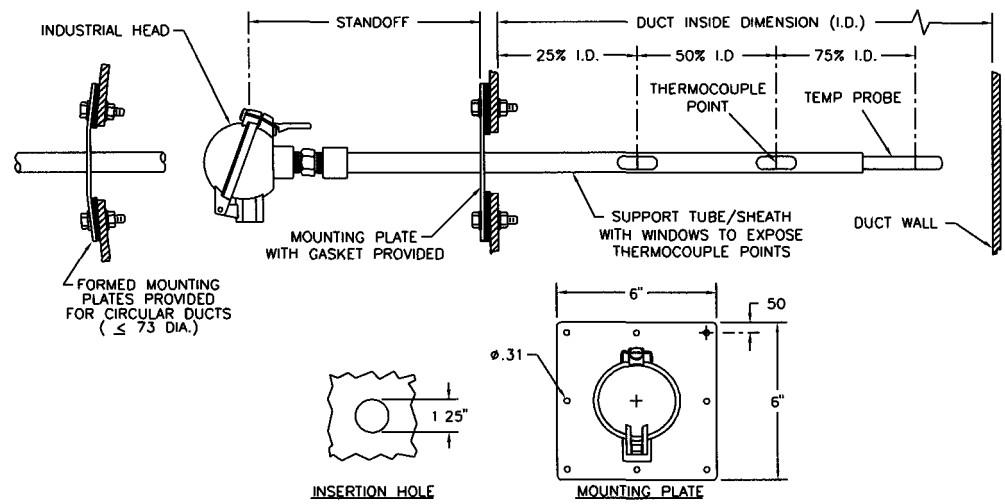
Thermocouple Type.
☐ K ☒ E ☐ J

Standoff.
☐ 9" (standard)
☐ Other _____

High Temperature Gasket.
☐ Silicone, 200°F to 400°F
☒ Fiber, 400°F to 900°F

Transmitter Type.
☐ Optically Isolated

DIMENSIONAL SPECIFICATIONS



* NOTE: PROBES OVER 72" LONG MAY REQUIRE A CENTER STRUCTURAL SUPPORT (BY OTHERS). CONTACT FACTORY.

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AIR MONITOR CORPORATION

IP7_027324

SUBMITTAL SHEET

COMPANION MOUNTING PLATE, EXTENDED
FOR MOUNTING TO FLAT CARBON STEEL DUCTS

STANDARD CONSTRUCTION

Plate.	¼" thick carbon steel plate
Fasteners.	¼-20 studs, lockwashers, and nuts
Standoff.	Schedule 40 pipe, carbon steel

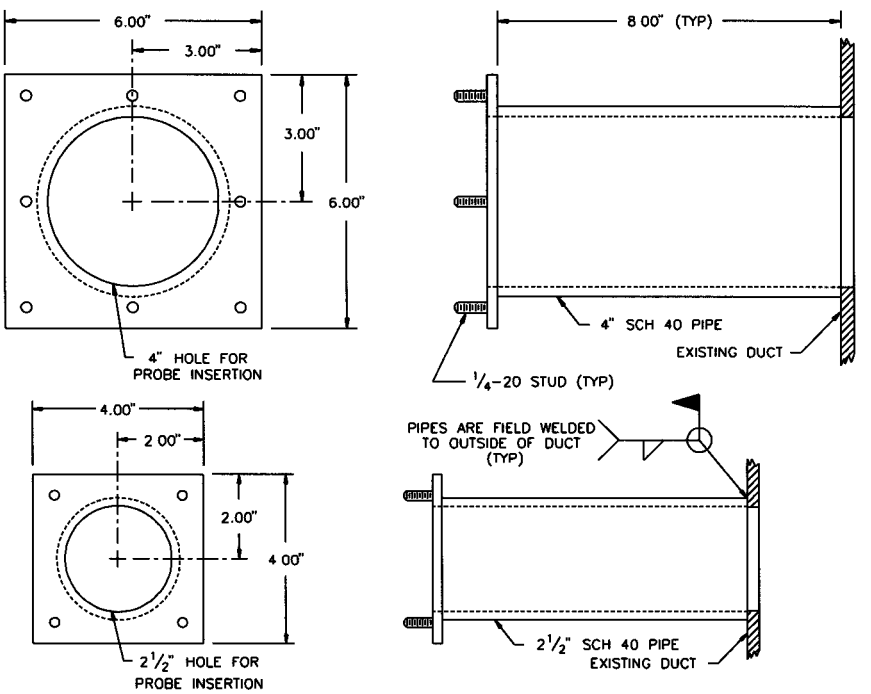
FUNCTION

This extended plate provides a means for mounting stainless steel VOLU-probes to the outside of insulated ducts

OPTIONAL SIZES

- ☐ 4" x 4" plate with 2½" Schedule 40 pipe. For probes 12" to 24" long
- ☑ 6" x 6" plate with 4" Schedule 40 pipe. For probes > 24" to 240" long

DIMENSIONAL SPECIFICATIONS (inches)



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SUBMITTAL SHEET

REMOTE TEMPERATURE TRANSMITTER ENCLOSURE
PROCESS TEMPERATURES ≥300°F

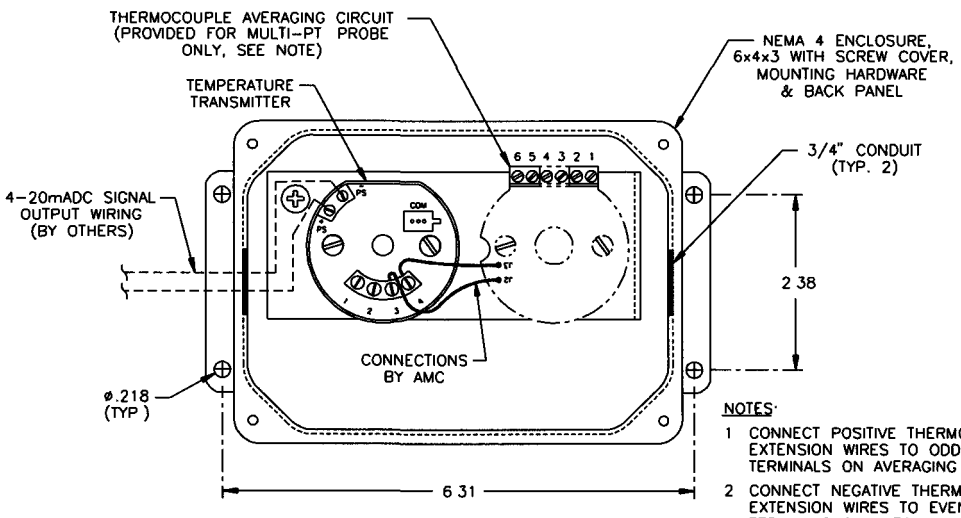
FUNCTION

To provide a non-isolated, linear to temperature, 4-20mADC signal from the temperature probe The transmitter is mounted in a NEMA 4 steel enclosure which is to be mounted in a remote location where the ambient temperature will not exceed 120°F Interconnect wire by others

OPTIONS

Optically Isolated Output

DIMENSIONAL SPECIFICATIONS

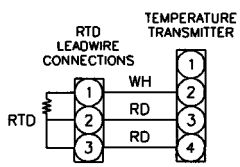


NOTES:

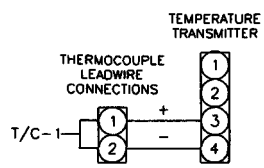
1 CONNECT POSITIVE THERMOCOUPLE EXTENSION WIRES TO ODD NUMBER TERMINALS ON AVERAGING BOARD

2 CONNECT NEGATIVE THERMOCOUPLE EXTENSION WIRES TO EVEN NUMBER TERMINALS ON AVERAGING BOARD.

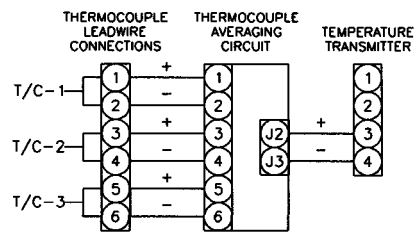
WIRING DETAILS



RTD



1-Point Thermocouple



3-Point Thermocouple

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4.22.3

IP7_027326

SUBMITTAL SHEET

TEMPERATURE TRANSMITTER
2-WIRE, LOOP POWER, 4-20mA

PERFORMANCE SPECIFICATIONS

				Conformance Range
Input Accuracy.	RTD	±0 04%	@ 77°F	–328°F to +1562°F
	Thermocouple, Type E	±0 022%	of Conformance Range	–274°F to +1832°F
	Thermocouple, Type J	±0 03%	of Conformance Range	–292°F to +1418°F
	Thermocouple, Type K	±0 02%	of Conformance Range	–238°F to +2502°F

Output Accuracy. RTD and Single Point Thermocouples. ±0 03% of Input Span Setting + Input Accuracy
Multi-Point Thermocouples ±0 03% of Input Span + Input Accuracy + Averaging Circuit Accuracy
Averaging Circuit Accuracy (%) $\frac{.02 \times (\text{Temp Gradient °F})}{(\text{Transmitter Span °F})} \times 100$

Cold Junction Reference Accuracy ±0 045%

Isolation. 1500 Vrms input to output to case (Isolated Model only)

Linearity. 0 1% of span, within rated ranges.

Over-Voltage Protection. 4V max (Input), 48V max (Output and Reverse Polarity protection on Output)

Load Capability. 500Ω @ 24V, typical
Non-Isolated Model $\frac{\text{Supply Voltage - 7V}}{024\text{A}} = \Omega$ Isolated Model. $\frac{\text{Supply Voltage - 10V}}{024\text{A}} = \Omega$

Burnout Protection. Total Sensor Diagnostics user-selected via Windows configuration software, upscale to 24mA (std) or downscale to 3 6mA Applies when all sensors in the temperature probe are burned out

Output Current Limiting. 21 4mA for input over-range, 23 6mA for sensor failure or broken wire

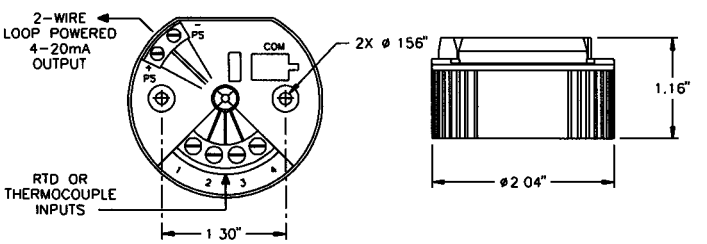
RTD Lead Wire Resistance Maximum. RTD Resistance + 2 times the lead wire resistance must be less than 4000Ω Recommend <35Ω per wire for 3-wire RTD inputs

AMBIENT CONDITIONS

Operating and Storage Range.	–40°F to +185°F
Relative Humidity.	0-95%, non-condensing
Effect of Ambient Temp on Accuracy.	±0 015% of span per °F change, max (+0 001% of Ω reading for RTD inputs)
Effect of Ambient Temp on Cold Junction Compensation.	±0 015°F per °F change

ADJUSTMENTS All settings made using Windows based configuration program, then stored in non-volatile FRAM memory Cable, software disk and instruction manual included with each transmitter

OPTIONS **Transmitter Type.** — Non-Isolated (standard) Optically Isolated



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4.22.8

IP7_027327

SUBMITTAL SHEET

CAMS
COMBUSTION AIRFLOW MANAGEMENT SYSTEM

STANDARD CONSTRUCTION

- ☑ Brass and Copper Construction — All wetted tubing, fittings, and valves constructed of copper and/or brass. Enclosure is NEMA 4 painted steel. External connection fittings are stainless steel FPT

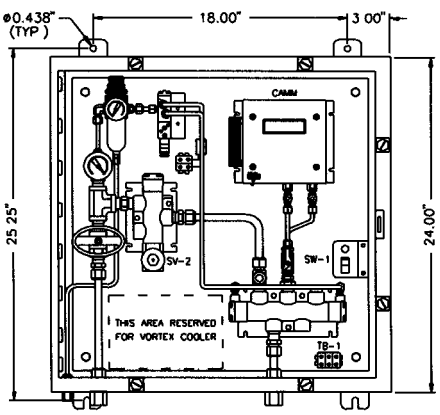
OPTIONAL CONSTRUCTION

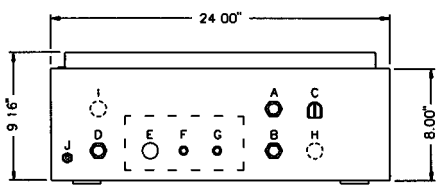
- ☐ NEMA 4X Stainless Steel Enclosure
- ☐ Vortex Cooler
- ☑ Viewing window

Power Supply

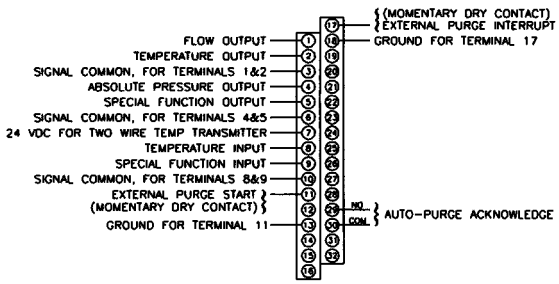
- ☐ 24VAC, 54VA
- ☐ 24VDC, 48VA
- ☑ 120VAC, 108VA

DIMENSIONAL SPECIFICATIONS

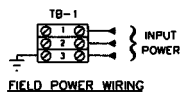




BOTTOM VIEW



FIELD CAMM WIRING



FIELD POWER WIRING

CONNECTION CODE.

A	STATIC PRESSURE, FROM FLOW STATION	1/2" FPT
B.	TOTAL PRESSURE, FROM FLOW STATION	1/2" FPT
C.	CABINET VENT	ø0.75"
D	SUPPLY AIR 80-125 PSIG	1/2" FPT
E.	VORTEX COOLER MOUNTING HOLE	ø1.125" I.D
F	VORTEX COOLER FILTER DRAIN	1/4" FPT
G.	VORTEX COOLER AIR SUPPLY	1/4" FPT
H.	ELECTRICAL CONNECTION POWER WIRING	3/4" K.O. (BY OTHERS)
I.	ELECTRICAL CONNECTION SIGNAL WIRING	3/4" K.O. (BY OTHERS)
J	SUPPLY AIR FILTER DRAIN	1/4" FPT

OPTIONAL

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6 20.4

SUB-M019, Rev 4 (2/99)

IP7_027328

SUBMITTAL SHEET

CAMM

COMBUSTION AIRFLOW MANAGEMENT MODULE

OPTIONS

Special Functions
- Summed Flow
- Differential Flow

Power
- 24VAC
- 20-40VDC
- 120VAC (via external transformer)

Certification
- Standard
- NIST Traceable

PERFORMANCE SPECIFICATIONS

Accuracy.
±0 1% of Natural Span, including non-linearity, hysteresis, and non-repeatability

Stability.
±0 5% of Natural Span for six months

Temperature Effect
Zero None, corrected by AUTO-zero
Span 0 015% of Full Span/°F

Mounting Position Effect.
None, corrected by AUTO-zero

Transducer Response Time.
0 5 second to reach 98% of a step change

Power Consumption.
54VA at 24VAC, 48VA at 24VDC, and 108VA at 120VAC

FUNCTIONAL SPECIFICATIONS

Digital Outputs.
Dual Form 'A' dry contacts for AUTO-purge activation and acknowledgment

Digital Inputs.
Dry contacts for AUTO-purge external start and purge interrupt commands

Analog Outputs.
Four outputs for flow, temperature, absolute pressure, and special function individually configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC

Analog Inputs.
Dual inputs are field configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC One is reserved for temperature input, the other for use with optional special function.

AUTO-purge Management.
AUTO-purge cycle is initiated via an external dry contact input, or via an internal timer with field selectable frequencies of 1 to 24 hours, in 1 hour increments An Form 'A' contact controls the AUTO-purge System, a second dry contact provides remote purge activation acknowledgment

Power Supply.
Standard 24VAC (20-28VAC) or 24VDC (20-40VDC), with automatic selection Optional 120VAC (100-132 VAC) via external UL listed transformer

Low Pass Filtration.
Response time to reach 98% of a step change is adjustable from 2 0 to 30 0 seconds

Automatic Zeroing.
Accuracy Within 0 1% of calibrated span
Frequency Every 1 to 24 hours selectable on 1 hour intervals

Overpressure and Static Pressure Limit.
25 psig

Circuit Protection.
Power input is fused and reverse polarity protected

Span and Zero Adjustment.
Digital, via internally located push-buttons

Displays.
Standard 4 line x 20 character LCD provides four lines of data display corresponding to the four analog outputs

Temperature Compensation Selection.
Push-button selection of linearized or nonlinear input Choice of thermocouple (Type E, K, J, and T) or 100 ohm platinum RTD temperature sensor type

Pressure Compensation.
Absolute pressure (atmosphere or duct static), up to 60"Hg

Humidity Limits.
0-95% RH, non-condensing.

Temperature Limits.
–20°F to 180°F Storage
+40°F to 140°F Operating

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6.8.2

SUB-B018, Rev 4 (8/01)

IP7_027329

SUBMITTAL SHEET

CAMM

COMBUSTION AIRFLOW MANAGEMENT MODULE

PHYSICAL SPECIFICATIONS

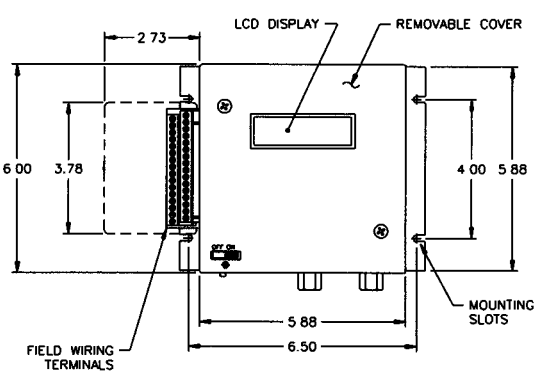
Signal Connections.
High and low pressure, 1/8" FPT

Electrical Connections.
External terminal strip with plug-in connectors.

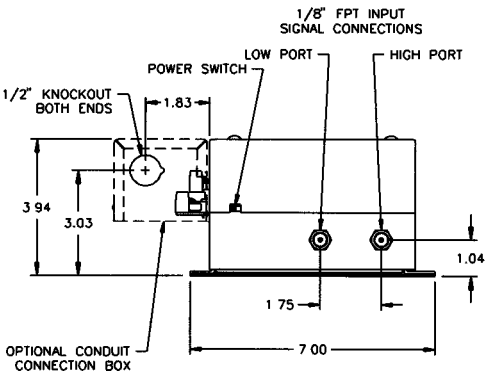
Enclosure.
NEMA 1 aluminum enclosure

Weight.
4 1 lbs

DIMENSIONAL SPECIFICATIONS

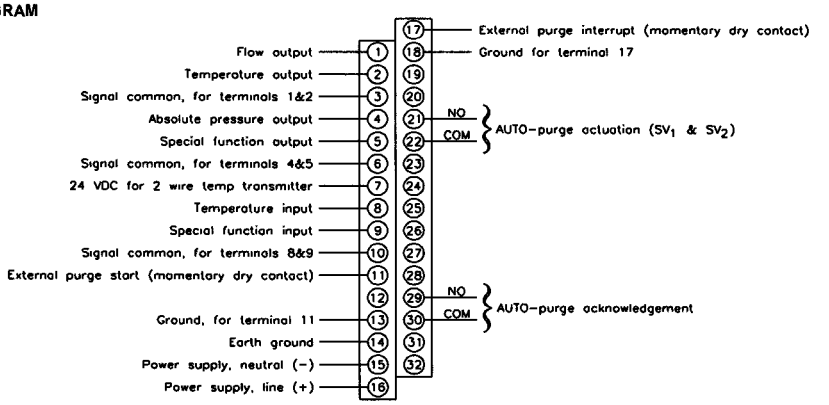


FRONT VIEW



BOTTOM VIEW

WIRING DIAGRAM



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6.8.4

SUB-B019, Rev 5 (10/02)

IP7_027330

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT: **INTERMOUNTAIN POWER**

WORK ORDER: **50600** *REV:* **2**

TAG(S): **FRONT OFA FEEDER DUCT (75" x 120")**

Given Information:

Fluid:	AIR		% H_2O (by volume):	
Standard Temperature (T_{std}):	68	(deg. F)	0.00	(%, by volume)
Standard Barometric Pressure (P_{std}):	29.921	(in. Hg)		
Air Temperature (T):	750	(deg. F)	Maximum Flow:	
Stack/Duct Pressure (P_g):	0.00	(in. w.c.)	387,000	(lb/hr)
Actual Barometric Pressure (P_{bar}):	24.000	(in. Hg)	Wet	(Wet/Dry)
Air Density at Standard Conditions, DRY:	0.07513	(lbs/ft^3)		
Duct Shape:	RECT		Square Root Extraction? (Yes/No)	
Duct Height:	75.000	(in.)	Yes	
Duct Width:	120.000	(in.)		
			Output:	
			4-20 mADC	

Calculations:

Duct Area (A_s):	62.500	(ft^2)
Maximum Actual Velocity:	3,924	(AFPM)
Absolute Duct Pressure (P_s):	24.000	(in. Hg)
Dry Mole Fraction of Duct (Mfd):	1.000	
Dry Molecular Wt. Of Air (Md):	28.965	(lb/lb-mole)
Wet Molecular Wt. Of Air (Ms):	28.965	(lb/lb-mole)
Air Density at Standard Conditions, WET:	0.07513	(lbs/ft^3)
Air Density at Actual Conditions, WET:	0.02630	(lbs/ft^3)

K-Factor: OFF

% FLOW (%)	Diff Press (in. w.c.)	Output (mADC)	Actual Flow (ACFM)	Std Flow/Dry (SCFM)	Std Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0.0000	4.00	00000				
10	0.0034	5.60	24,528	8,585	8,585	38,700	38,700
20	0.0135	7.20	49,055	17,170	17,170	77,400	77,400
30	0.0303	8.80	73,583	25,755	25,755	116,100	116,100
40	0.0538	10.40	98,111	34,340	34,340	154,800	154,800
50	0.0841	12.00	122,641	42,926	42,926	193,500	193,500
60	0.1211	13.60	147,169	51,511	51,511	232,200	232,200
70	0.1648	15.20	171,697	60,096	60,096	270,900	270,900
80	0.2152	16.80	196,224	68,681	68,681	309,600	309,600
90	0.2724	18.40	220,752	77,266	77,266	348,300	348,300
100	0.3363	20.00	245,280	85,851	85,851	387,000	387,000

Transmitter:	CAMM	Power (voltage/type):	24VAC
Flow Element:	VOLU-probe/SS w/Temp Probe	Power Configuration:	4-Wire
Transmitter Maximum Range:	0 - 387,000 LB/HR	Square Root:	ON
Temperature Range:	0 to 750°F	Density Compensation:	ON
Pressure Comp. Range:	24.00 to 32.00 in. Hg		

Temperature Sensor: 3-Pt. Type "E" T/C Probe with remote 4-20mADC temperature transmitter.

Display Line #1:	0 - 387,000 LB/HR	(FLOW)
Display Line #2:	0 to 750°F	(TEMPERATURE)
Display Line #3:	24.00 to 32.00 in. Hg	(ABSOLUTE PRESSURE)
Display Line #4:	0.000 to 0.336 IN w.c.	(DIFFERENTIAL PRESSURE)

IP7_027331

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT: **INTERMOUNTAIN POWER**

WORK ORDER: **50600** *REV:* **1**

TAG(S): **REAR OFA FEEDER DUCT (77" x 120")**

Given Information:

Fluid:	AIR		% H_2O (by volume):	
Standard Temperature (T_{std}):	68	(deg. F)	0.00	(%, by volume)
Standard Barometric Pressure (P_{std}):	29.921	(in. Hg)		
Air Temperature (T):	750	(deg. F)	Maximum Flow:	
Stack/Duct Pressure (P_g):	0.00	(in. w.c.)	387,000	(lb/hr)
Actual Barometric Pressure (P_{bar}):	24.000	(in. Hg)	Wet	(Wet/Dry)
Air Density at Standard Conditions, DRY:	0.07513	(lbs/ft^3)		
Duct Shape:	RECT		Square Root Extraction? (Yes/No)	
Duct Height:	77.000	(in.)	Yes	
Duct Width:	120.000	(in.)		
			Output:	
			4-20 mADC	

Calculations:

Duct Area (A_s):	64.167	(ft^2)
Maximum Actual Velocity:	3,823	(AFPM)
Absolute Duct Pressure (P_s):	24.000	(in. Hg)
Dry Mole Fraction of Duct (Mfd):	1.000	
Dry Molecular Wt. Of Air (Md):	28.965	(lb/lb-mole)
Wet Molecular Wt. Of Air (Ms):	28.965	(lb/lb-mole)
Air Density at Standard Conditions, WET:	0.07513	(lbs/ft^3)
Air Density at Actual Conditions, WET:	0.02630	(lbs/ft^3)

K-Factor: OFF

% FLOW (%)	Diff Press (in. w.c.)	Output (mADC)	Actual Flow (ACFM)	Std Flow/Dry (SCFM)	Std Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0.0000	4.00	00000				
10	0.0032	5.60	24,528	8,585	8,585	38,700	38,700
20	0.0128	7.20	49,055	17,170	17,170	77,400	77,400
30	0.0287	8.80	73,583	25,755	25,755	116,100	116,100
40	0.0510	10.40	98,111	34,340	34,340	154,800	154,800
50	0.0798	12.00	122,641	42,926	42,926	193,500	193,500
60	0.1149	13.60	147,169	51,511	51,511	232,200	232,200
70	0.1563	15.20	171,697	60,096	60,096	270,900	270,900
80	0.2042	16.80	196,224	68,681	68,681	309,600	309,600
90	0.2584	18.40	220,752	77,266	77,266	348,300	348,300
100	0.3191	20.00	245,280	85,851	85,851	387,000	387,000

Transmitter:	CAMM	Power (voltage/type):	24VAC
Flow Element:	VOLU-probe/SS w/Temp Probe	Power Configuration:	4-Wire
Transmitter Maximum Range:	0 - 387,000 LB/HR	Square Root:	ON
Temperature Range:	0 to 750°F	Density Compensation:	ON
Pressure Comp. Range:	24.00 to 32.00 in. Hg		

Temperature Sensor: 3-Pt. Type "E" T/C Probe with remote 4-20mADC temperature transmitter.

Display Line #1:	0 - 387,000 LB/HR	(FLOW)
Display Line #2:	0 to 750°F	(TEMPERATURE)
Display Line #3:	24.00 to 32.00 in. Hg	(ABSOLUTE PRESSURE)
Display Line #4:	0.000 to 0.319 IN w.c.	(DIFFERENTIAL PRESSURE)

AIR MONITOR CORPORATION

TRANSMITTER SPAN/MASS FLOW CALCULATIONS

PROJECT **INTERMOUNTAIN POWER**

WORK ORDER **50600** *REV* **0**

TAG(S) **INDIVIDUAL OFA PORT (39.50" x 25.50")**

Given Information:

Fluid.	AIR	
Standard Temperature (T_{std}).	68	(deg F)
Standard Barometric Pressure (P_{std}):	29.921	(in Hg)
Air Temperature (T)	665	(deg F)
Stack/Duct Pressure (P_g)·	3.00	(in w c)
Actual Barometric Pressure (P_{bar}):	25.082	(in Hg)
Air Density at Standard Conditions, DRY.	0.07513	(lbs/ft^3)
Duct Shape.	RECT	
Duct Height:	39.500	(in)
Duct Width.	25.500	(in)

% H_2O (by volume): 0.00 (%, by volume)

Maximum Flow. 88,000 (lb/hr)

Wet (Wet/Dry)

Square Root Extraction? (Yes/No) Yes

Output: 4-20 mADC

Calculations:

Duct Area (A_s):	6 995	(ft^2)
Maximum Actual Velocity:	7,032	(AFPM)
Absolute Duct Pressure (P_s).	25 303	(in Hg)
Dry Mole Fraction of Duct (Mfd):	1 000	
Dry Molecular Wt Of Air (Md).	28 965	(lb/lb-mole)
Wet Molecular Wt Of Air (Ms)·	28 965	(lb/lb-mole)
Air Density at Standard Conditions, WET.	0 07513	(lbs/ft^3)
Air Density at Actual Conditions, WET.	0 02982	(lbs/ft^3)

K-Factor· OFF

% FLOW (%)	Diff. Press (in w c)	Output (mADC)	Actual Flow (ACFM)	Std Flow/Dry (SCFM)	Std Flow/Wet (SCFM)	MassFlow/Dry (Lbs/Hr)	MassFlow/Wet (Lbs/Hr)
0	0 0000	4 00	00000				
10	0 0122	5 60	4,918	1,952	1,952	8,800	8,800
20	0 0490	7 20	9,836	3,904	3,904	17,600	17,600
30	0 1102	8 80	14,757	5,857	5,857	26,400	26,400
40	0 1959	10 40	19,675	7,809	7,809	35,200	35,200
50	0 3061	12 00	24,594	9,761	9,761	44,000	44,000
60	0 4408	13 60	29,512	11,713	11,713	52,800	52,800
70	0 5999	15 20	34,430	13,665	13,665	61,600	61,600
80	0 7835	16 80	39,348	15,617	15,617	70,400	70,400
90	0 9917	18 40	44,269	17,570	17,570	79,200	79,200
100	1 2243	20 00	49,187	19,522	19,522	88,000	88,000

Transmitter: (Not supplied by Air Monitor)

Flow Element. VOLU-probe/SS

Power (voltage/type)· N/A

Power Configuration· N/A

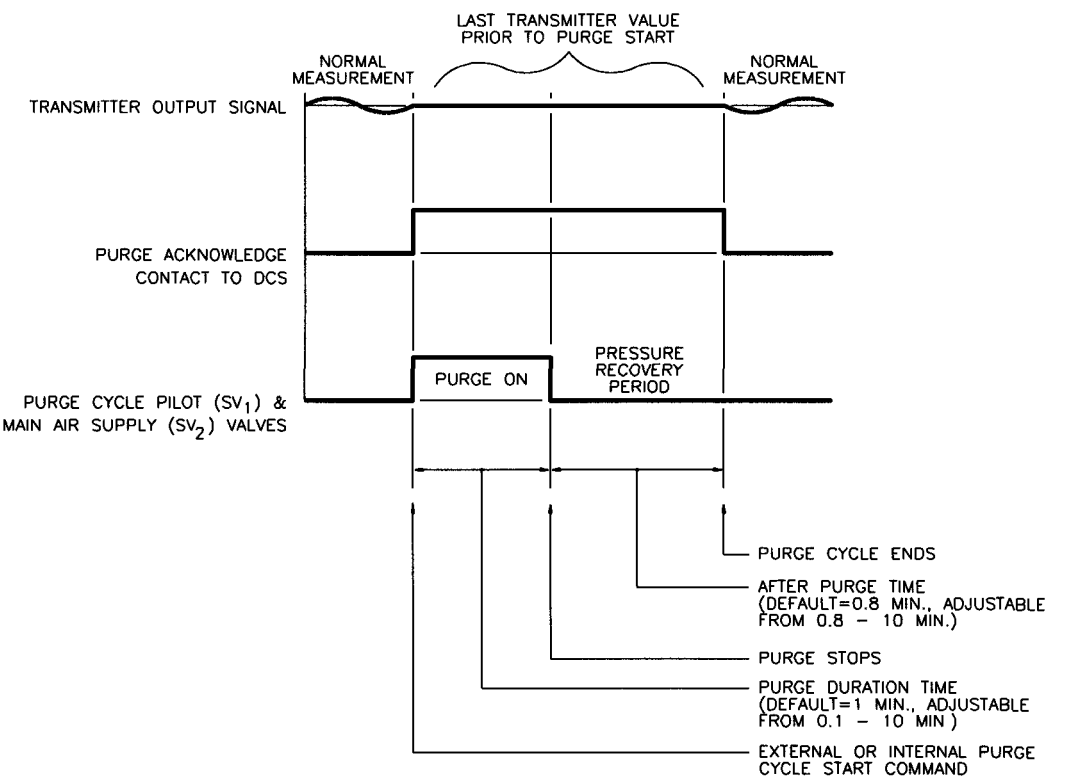
Transmitter Maximum Range. N/A

Square Root: ON

CAMM

PURGE CYCLE TIMING DIAGRAM

TIMING DIAGRAM



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AIR MONITOR CORPORATION

SUB-B024, Rev 3 (10/97)

SUBMITTAL SHEET

CAMS
INSTALLATION GUIDE

Air Requirement.

80 to 125 psig at 100 CFM, oil and dirt free 1 to 24 purge cycles per day, with a field selectable duration between 30 and 120 seconds during which compressed air is released

Line Size from CAMS Panel to Flow Measuring Station or Probes.

Distance from CAMS panel to flow measuring station air probe.	Tube Size.
< 25'	1/2" S S tube
25' - 50'	3/4" S S tube
> 50'	1 0" S S tube

Accumulator Tank (strongly recommended).
Requires coalescing filter, pressure regulator, and check valve at the tank inlet

120 gallons - All CA stations
120 gallons - Multiple VOLU-probes having a combined length greater than 10'
80 gallons - One or more VOLU-probes having a combined length less than 10'

Line from Accumulator Tank to CAMS Panel.

25' maximum length, ½" pipe (minimum) Recommend locating accumulator tank as close as possible to CAMS panel

Electrical Power Requirement.

- 24VAC, 54VA
- 24VDC, 48VA
- 120VAC, 108VA

Ambient Temperature.

40°F-140°F For ranges above or below this ambient temperature, use of panel heater and/or cooler is required

Purge Frequency.

Once/day minimum, once/hour maximum

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AIR MONITOR CORPORATION

6.23.2

IP7_027335

SUBMITTAL SHEET

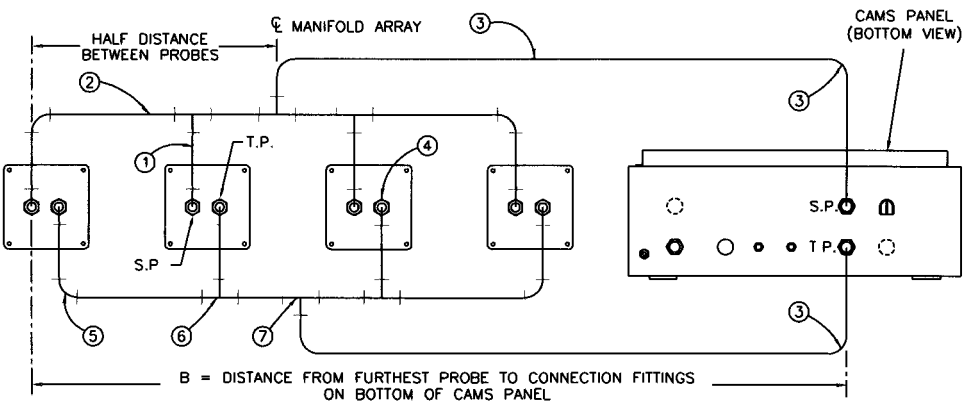
CAMS

TUBING REQUIREMENT FROM AIRFLOW MEASURING PROBES TO THE AUTO-purge PANEL

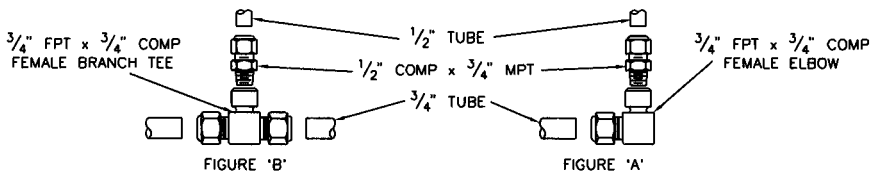
FUNCTION

This Submittal Sheet specifies the signal tubing sizes and fitting requirements from the connection fittings on the probes to the center of the manifolding arrays, and from the center of the manifolding arrays to the connection fittings on the bottom of the AUTO-purge Panel

TUBING LAYOUT



COMPONENT	IF LENGTH "B" IS 25 FEET OR LESS	IF LENGTH 'B' IS GREATER THAN 25 FEET
①	TUBE, 1/2" O.D. x .035 WALL	TUBE, 1/2" O.D x .035 WALL
②	TUBE, 1/2" O D. x .035 WALL	TUBE, 3/4" O D. x .035 WALL
③	TUBE, 1/2" O.D. x .035 WALL	TUBE, 3/4" O.D. x .035 WALL
④	FITTING, 1/2" MPT x 1/2" COMP ELBOW	FITTING, 1/2" MPT x 1/2" COMP ELBOW
⑤	FITTING, 1/2" COMP ELBOW	SEE FIGURE 'A' BELOW
⑥	FITTING, 1/2" COMP TEE	SEE FIGURE 'B' BELOW
⑦	FITTING, 1/2" COMP TEE	FITTING, 3/4" COMP TEE



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AIR MONITOR CORPORATION

SUB-M029, Rev 0 (5/99)

WARRANTY

PROCESS / POWER

PRODUCTS COVERED

AUTO-purge III **AUTO-purge/CEM** **CAMS**

WARRANTY

Air Monitor Corporation (hereinafter referred to as "Seller") warrants that at the time of shipment, products sold pursuant to this contract will be free from defects in materials and workmanship, and will conform to the specifications furnished or approved in writing by Seller. No warranty is given that delivered products will conform to catalog sheets, data sheets, and the like, which are subject to change without notice.

Seller will repair or replace, at its option, any products listed under this warranty which is returned freight pre-paid to Seller within the earlier of two (2) years after start-up or twenty-seven (27) months after shipment that, upon test and examination, proves defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period of the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as thermocouples, electrodes, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

Seller shall not be liable for any special or consequential damages or for loss of damage, directly or indirectly arising from the use of the products. Seller's warranty shall be limited to replacement of defective equipment and shall not include field removal and installation expenses.

The warranty set forth above is in lieu of all other warranties either express or implied and constitutes the full extent of Air Monitor Corporation's liability to the customer, or any other party for breach of warranty. THERE ARE NO EXPRESS WARRANTIES EXCEPT AS SET FORTH HEREIN. THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, WHICH ARE PARTICULARLY DISCLAIMED.

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AIR MONITOR CORPORATION

WARRANTY

PROCESS / POWER

PRODUCTS COVERED

FAN-E/SS	**VOLU-probe/SS**	**VOLU-probe/VS-SS**	**CA Stations**
LO-flo/SS	**VOLU-probe/SM**	**VOLU-probe/FI-SS**	**IBAMS**
SAP	**SOAP**	**STAT-probe/1SS**	**STACK-probe**

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Seller will repair or replace, at its option, any products listed under this warranty which is returned *freight pre-paid to Seller within the earlier of one (1) year after start-up or fifteen (15) months after* shipment that, upon test and examination, proves defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period of the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as thermocouples, electrodes, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

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AIR MONITOR CORPORATION

From: "Matt Maragos" <mmaragos@airmonitor.com>
To: "'Jerry Finlinson'" <Jerry-F@ipsc.com>
CC: "'Bill Morgan'" <BILL-M@ipsc.com>, "'Howard Scott'" <HOWARD-S@ipsc.com>,...
Date: 4/7/2009 6:54 AM
Subject: RE: Air monitor pitot probe supports

Jerry,

We're not too worried about thermal expansion / contraction considering the debris that has accumulated between the socket end support and the probe. I understand it won't wiggle, so axial movement is limited - but the socket and probe are both stainless so their thermal coefficients are the same. We don't know if it will ride up and down (impossible to know without removing the probe since it is fixed to the top of the duct), but again, we are not concerned about this. Many applications are fixed with an end support stud and little to no room to move.

We don't believe it is necessary to clean the socket out.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 3:32 PM
To: 'Janet Bauman'; Matt Maragos; 'Ken Hall'
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: RE: Air monitor pitot probe supports

Matt,
We have a question about our primary air pitots. They are inserted from
the top of the duct and go through some holes in the bottom of the duct with a cleanout cap. We noticed on a few mills and particularly E mill. That the hole in the bottom was stuffed with rocks and the pitots won't wiggle.
This might be bad because it could put stress on the pitot when the duct expands and
crack or bend the pitot.

Last year we had a broken pitot and when we were trying to take it off the bolts broke on the mounting plate. We are reluctant to try taking the plate off the bottom because of potential breakage.

In you opinion, how serious is it that the pitot is jammed up tight and won't
wiggle. Should we put major effort into cleaning that out?
see the attached photo.

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

There's always more to do than you can do. Prioritize!

>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/2/2008 4:18 PM >>>
Jerry,

First complaint on the companion mounting plates that we have received, but keep in mind that most probes are never removed from the duct.

We'll get a couple new plates out to you ASAP (no charge), but they will have small diameter bolts. That's all we have in stock.

In retrospect (hindsight is always 20:20), it may have been better to provide extended companion mounting plates on this project that would have cleared the duct insulation. This may have cut back on the corrosion and would have made probe removal possible without pulling back the insulation. Also, in the event of bolt failure, there would have been access to both sides of the mounting plate, making replacement of the bolts easier.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Wednesday, April 02, 2008 2:30 PM
To: Janet Bauman; Matt Maragos; Ken Hall
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: Air monitor pitot probe supports

FYI,
I've got some negative feedback on the design of your air monitor pitot supports.
The bolts are too small of diameter. I asked the tech to take the removable caps off
the bottom of the B mill duct to check for dust in the bottom of the probe.
On several of them the 1/4 inch studs broke off while trying to remove the nuts.
So we only got one off successfully. It was OK with not much dust in the bottom of the
probe.

Since we have one broken pitot probe, we removed it from the duct so that we could do
a weld repair in the shop. The 1/4 inch bolts are all rusty and all 4 of those broke off even

after soaking overnight with Kroil.

So now we need to do some kind of bolt repair so that we can mount the pitot back.
I suppose we could order another plate with bolts that could be cut off and rewelded on.

I really think you should have a larger bolt diameter and use some bolts that could
handle the environment and still be able to get the nuts off a few years later.

What is your other experience with those bolts?
Do you have any good suggestions about how to get the nuts off without breaking the bolts?

How much would a new bolt plate cost?
Is that something you stock that we could get in a timely manner?

Thanks,

Jerry

Jerry Finlinson, Control Engineer
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435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com
What's the best thing you could be working on, and why aren't you? Richard Hamming

From: "Matt Maragos" <mmaragos@airmonitor.com>
To: "'Jerry Finlinson'" <Jerry-F@ipsc.com>
CC: "'Bill Morgan'" <BILL-M@ipsc.com>, "'Howard Scott'" <HOWARD-S@ipsc.com>,...
Date: 4/7/2009 7:53 AM
Subject: RE: Air monitor Overfired air pitot guide tube question

Jerry,

I am out of the office for the next couple of days. I would like to get a better look at our drawings (the one you attached was of the OFA ports, that probe is only ~39").

Do you know how hot this location has been getting? Maximum temperature if you can find it. I would like to see how much of an expansion change we are getting.

I am checking on how close the probes should be to the end of the socket. I will have an answer back today. I like the idea of an upstream hole and downstream hole to allow for the ash to escape or be cleaned out. Is there enough moisture (perhaps during outage) that ash is solidifying in these locations (in the socket cups)?

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 5:10 PM
To: Matt Maragos
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson
Subject: Air monitor Overfired air pitot guide tube question

Matt,
Thanks for the response. That leads me to another question. In our Overfired air ducts we have some longer probes. In unit 1, the guide cylinder was installed on the bottom of the duct, instead of the top and now they are packed with flyash. As a results the pitots in the north west duct are bending. We have some options.

1) We could cut out all the pitots and tubing inside the duct, turn them upside down and reinstall with the guide cylinders on the top. However, that would be a lot of welding work and require a recalibration.

2) We are considering drilling a hole in the front and back of the guide cylinder close to the floor, which would allow the flyash to be poked out or even
come out on it's own. We wonder how close to the duct floor the pitot is inside the guide cylinder. see attached photos.

According to the original submittal, the probes are only 1/4 inch shorter than
the duct heights of 75 inches and 77 inches.

What is your advise?

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

There's always more to do than you can do. Prioritize!

>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/6/2009 5:41 PM >>>
Jerry,

We're not too worried about thermal expansion / contraction considering the debris that has accumulated between the socket end support and the probe. I understand it won't wiggle, so axial movement is limited - but the socket and probe are both stainless so their thermal coefficients are the same. We don't know if it will ride up and down (impossible to know without removing the probe since it is fixed to the top of the duct), but again, we are not concerned about this. Many applications are fixed with an end support stud and little to no room to move.

We don't believe it is necessary to clean the socket out.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 3:32 PM
To: 'Janet Bauman'; Matt Maragos; 'Ken Hall'
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: RE: Air monitor pitot probe supports

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wiggle. Should we put major effort into cleaning that out?
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cell 435-406-4754
jerry-f@ipsc.com

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From: Jerry Finlinson
To: Matt Maragos
Date: 4/7/2009 9:34 AM
Subject: RE: Air monitor Overfired air pitot guide tube question

Matt,
In the drawings I sent you on page 2 is a description of the ports and the heights of 75 and 77 inches, then it says that the probe length is A - 0.25 inches.

The temperature of the overfired air is in the range of 700 to 740 F.

During outages, there is some moisture when we go inside and do a snoop leak check of the pitots. That should be the only time there is moisture there.

Our main concern is that when we are drilling the upsteam and downstream hole in the socket cup, we don't want to cut into the end of the pitot tube.

Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

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>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/7/2009 7:52 AM >>>
Jerry,

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I am checking on how close the probes should be to the end of the socket. I will have an answer back today. I like the idea of an upstream hole and downstream hole to allow for the ash to escape or be cleaned out. Is there enough moisture (perhaps during outage) that ash is solidifying in these locations (in the socket cups)?

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Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 5:10 PM

To: Matt Maragos
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson
Subject: Air monitor Overfired air pitot guide tube question

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come out on it's own. We wonder how close to the duct floor the pitot is inside the guide cylinder. see attached photos.

According to the original submittal, the probes are only 1/4 inch shorter than
the duct heights of 75 inches and 77 inches.

What is your advise?

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
jerry-f@ipsc.com

There's always more to do than you can do. Prioritize!

>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/6/2009 5:41 PM >>>
Jerry,

We're not too worried about thermal expansion / contraction considering the debris that has accumulated between the socket end support and the probe. I understand it won't wiggle, so axial movement is limited - but the socket and probe are both stainless so their thermal coefficients are the same. We don't know if it will ride up and down (impossible to know without removing

the probe since it is fixed to the top of the duct), but again, we are not concerned about this. Many applications are fixed with an end support stud and little to no room to move.

We don't believe it is necessary to clean the socket out.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 3:32 PM
To: 'Janet Bauman'; Matt Maragos; 'Ken Hall'
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: RE: Air monitor pitot probe supports

Matt,
We have a question about our primary air pitots. They are inserted from
the top of the duct and go through some holes in the bottom of the duct with a cleanout cap. We noticed on a few mills and particularly E mill. That the hole in the bottom was stuffed with rocks and the pitots won't wiggle.
This might be bad because it could put stress on the pitot when the duct expands and
crack or bend the pitot.

Last year we had a broken pitot and when we were trying to take it off the bolts broke on the mounting plate. We are reluctant to try taking the plate off the bottom because of potential breakage.

In you opinion, how serious is it that the pitot is jammed up tight and won't
wiggle. Should we put major effort into cleaning that out?
see the attached photo.

Thanks, Jerry

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From: Jerry Finlinson
To: Matt Maragos
Date: 4/15/2009 11:29 AM
Subject: RE: Air monitor Overfired air pitot guide tube question

Matt,
You were going to advise us how much room there is beneath the probes. Do you have a record of how long the probes were that were shipped to us?
Thanks, Jerry

Jerry Finlinson, Control Engineer
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Delta, UT 84624
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jerry-f@ipsc.com

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>>> "Matt Maragos" <mmaragos@airmonitor.com> 4/7/2009 7:52 AM >>>
Jerry,

I am out of the office for the next couple of days. I would like to get a better look at our drawings (the one you attached was of the OFA ports, that probe is only ~39").

Do you know how hot this location has been getting? Maximum temperature if you can find it. I would like to see how much of an expansion change we are getting.

I am checking on how close the probes should be to the end of the socket. I will have an answer back today. I like the idea of an upstream hole and downstream hole to allow for the ash to escape or be cleaned out. Is there enough moisture (perhaps during outage) that ash is solidifying in these locations (in the socket cups)?

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Monday, April 06, 2009 5:10 PM
To: Matt Maragos
Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson
Subject: Air monitor Overfired air pitot guide tube question

Matt,
Thanks for the response. That leads me to another question. In our Overfired air ducts we have some longer probes. In unit 1, the guide cylinder was installed on the bottom of the duct, instead of the top and now they are packed with flyash. As a results the pitots

in the north west duct are bending. We have some options.

1) We could cut out all the pitots and tubing inside the duct, turn them upside down and reinstall with the guide cylinders on the top. However, that would be a lot of welding work and require a recalibration.

2) We are considering drilling a hole in the front and back of the guide cylinder close to the floor, which would allow the flyash to be poked out or even
come out on it's own. We wonder how close to the duct floor the pitot is inside the guide cylinder. see attached photos.

According to the original submittal, the probes are only 1/4 inch shorter than
the duct heights of 75 inches and 77 inches.

What is your advise?

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Cc: Bill Morgan; Howard Scott; Jim Knapp; John Fritzges; Ken Nielson; Mike Nuttall
Subject: RE: Air monitor pitot probe supports

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cell 435-406-4754
jerry-f@ipsc.com

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From: Jerry Finlinson
To: Howard Scott; Jim Knapp
CC: Ken Nielson
Date: 4/18/2009 8:54 PM
Subject: Unit 2 SE OFA air prefilters melted and leaking
Attachments: U2 OFA SE filters melted and leaking.JPG

FYI,
Saturday while coming down unit 2, I noticed that the south east overfire air pitot tube purge panel has a very leaky filter.
There are 2 Parker filters, a prefilter and coalescing filter. The south east ones are melted and leaking. It must have gotten very hot there. You will need to order new filters.

Parker P3NFA98FSA and
Parker P3NFA98DSA.

see attached photo.

Jerry

Jerry Finlinson, Control Engineer
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Delta, UT 84624
435-864-6466 FAX 0776
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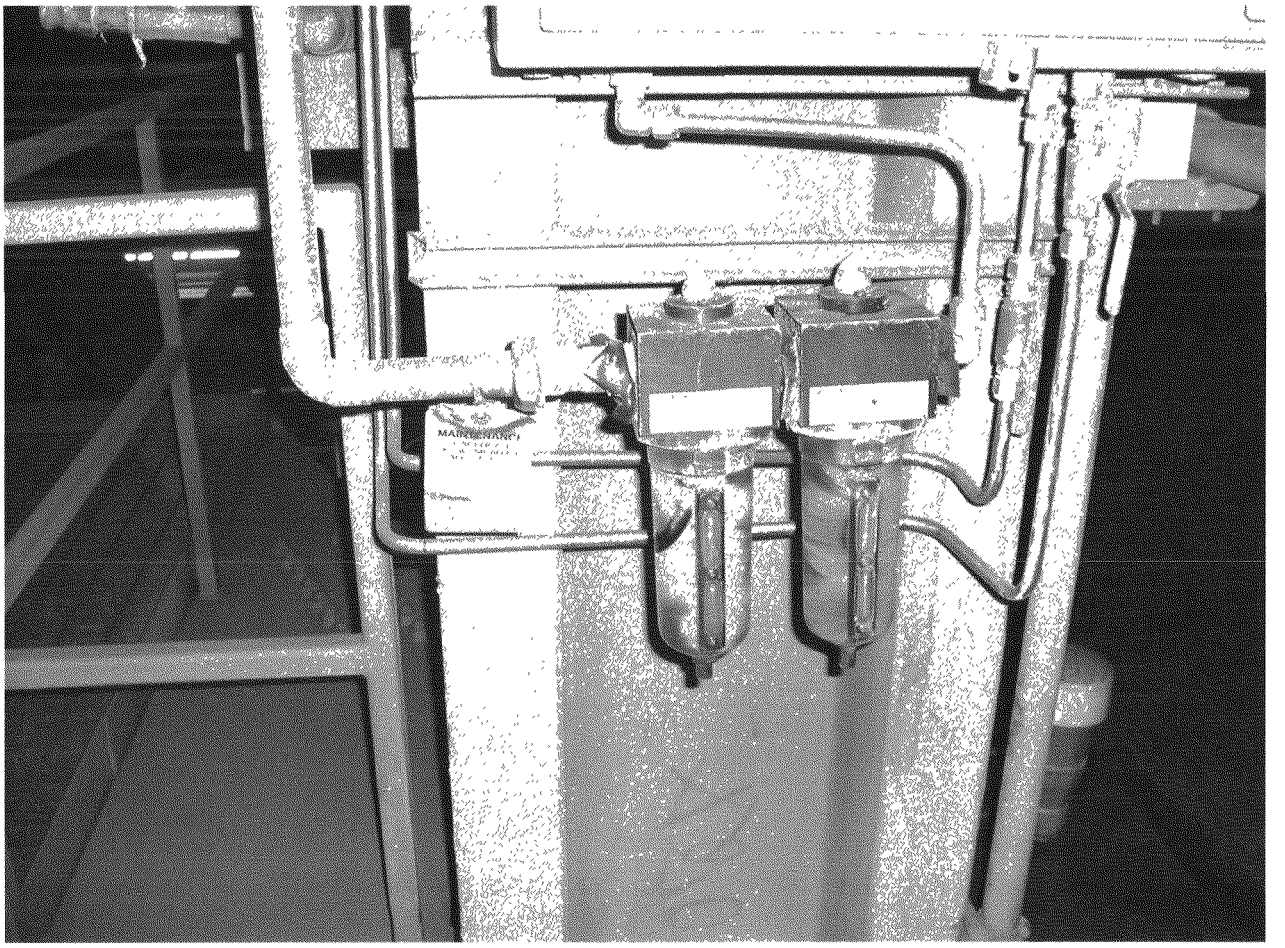

IP7_027352

From: Jim Knapp
To: Jerry Finlinson
Date: 4/20/2009 7:03 AM
Subject: Re: Unit 2 SE OFA air prefilters melted and leaking

This has been written up on work order 09-90222-0. From looking at this, it appears to me as if the air inside the 1" copper pipe was over heated. Does this pipe run too close to something very hot?

Jim Knapp
I&C Maintenance Planner
Intermountain Power Service Corp.
850 West Brush Wellman Road
Delta, UT 84624-9546

Phone 435-864-6830
Fax 435-864-0930 or 435-864-6865

>>> Jerry Finlinson 4/18/2009 8:54 PM >>>
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There are 2 Parker filters, a prefilter and coalescing filter. The south east ones are melted and leaking. It must have gotten very hot there. You will need to order new filters.

Parker P3NFA98FSA and
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see attached photo.

Jerry

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There's always more to do than you can do. Prioritize!

From: Jerry Finlinson
To: Mark Panhorst
CC: Gary Dean; Jim Knapp; Ken Nielson
Date: 5/21/2009 7:48 AM
Subject: OFA Flowmeters add to IPSC database
Attachments: OFA Flowmeter List.xls; Air Mon CAMS params OFA Updated 09Apr12.wpd

Mark,
Here is a list of the OFA Flowmeters that need to be added to the IPSC Technical Database. They are already in Datatrak.

OFA Flowmeter List
Jerry Finlinson
These are all located on the boiler 9th level

1SGB-FT-155	OFA SW Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
1SGB-FT-156	OFA SE Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
1SGB-FT-157	OFA NW Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
1SGB-FT-158	OFA NE Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
2SGB-FT-155	OFA SW Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
2SGB-FT-156	OFA SE Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
2SGB-FT-157	OFA NW Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
2SGB-FT-158	OFA NE Inlet Flow	Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe

I have included the latest parameter setup file. Note that the north and south sides have different duct dimensions.

S:\I&EDATA\AIR MONITOR\OVERFIRE AIR

Let me know if you need further info.

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
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Delta, UT 84624
435-864-6466 FAX 0776
cell 435-406-4754
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OFA Flowmeter List
Jerry Finlinson
These are all located on the boiler 9th level

1SGB-FT-155	OFA SW Inlet Flow
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2SGB-FT-156	OFA SE Inlet Flow
2SGB-FT-157	OFA NW Inlet Flow
2SGB-FT-158	OFA NE Inlet Flow

Air Monitor CAMS system w/ Volu-probe/2SS traverse air flow probe
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Air Monitor CAMS Setup Parameters
OVERFIRE AIR Updated 14 June 2007

U1 = Veltron IIB CPU board 4.40A 10601 800 Rev C
U2 = Veltron IIB CPU board 4.40A 10601 800 Rev D wo 50600

Serial Numbers: NE = B26913, NW = B26914, SE = B26915, SW = B26916.

1. Transmitter Scaling and Config

Process Config

Density Comp	-	ON
Density Comp Type	-	Mass
Temp/Press	-	Temp & Abs press
Process Type	-	Transmitter Flow
Process Units	-	Flow lb/hr
Process Format	-	Flow XXXX, X00 lb/hr
Process Minimum	-	Flow 00 lb/hr
Maximum	-	387,000 lbm/hr
Duct Area Units	-	Square Feet
Duct Area Range	-	0 - 325.00 sq/ft
Duct Area	-	SOUTH=59.17 sq/ft, NORTH=64.17
Temperature Units	-	° F =62.5
Barometric Pres Units	-	in. Hg
Output Lockdown	-	10.0% FS output
exit		

Temp Config

Input Linearization	-	OFF, NE = ON
Minimum Temperature	-	0° F
Maximum Temperature	-	750° F
Default Temp	-	665° F
Temp Fault Output	-	Default Temp
exit		

Absolute Pressure Config

Abs Press off/on	-	ON
Min Abs Pressure	-	24 in.Hg
Max Abs Pressure	-	32 in.Hg
exit		

Calculator for Max Flow

Calculate DP/Flow	-	Diff Press
Standard Temperature	-	68° F
Process Temperature	-	68° F
Static Pressure Units	-	in.WC
Process Static Press	-	0.0 in.WC
Bar Pres or Elevt'n	-	Barometric Pressure
Barometic Pressure	-	29.92 in.Hg - measurement
Wet/Dry Flow Basis	-	WET
Percentage Water	-	0.00%

Dry Molecular Weight - 28.966 lb/lb mole
Pitot Tube Coeffic- - 1.0
Calc Max Flow - 1,128,000 lb/hr
Calculate Diff Pres - SOUTH=0.13132 in.WC - measurement
NORTH=0.11166 in WC
Update Operating Span - NO
Reset Calc Default Values - NO
exit

Return to Main

2. Low Pass Filter Selection
   Low Pass filter - 6 - Needs more filtering as the signal is noisy and small.

3. Auto-Zero Config
   Auto-Zero Off/On Select - ON
   Auto-Zero Interval - 4HR

4. Auto-Purge Config
   Auto-Purge Off/On Select - ON
   Auto-Purge Activtn Select - INTERNAL ONLY
   Auto-Purge Interval - 23.65 hr = H

CORNER	PURGE INTERVAL
SW	8 HR
SE	8.05 HR
NE	8.15 HR
NW	8.10 HR

   Purge Duration - 1.0 Min
   After Purge Duration - 1.5 Min

5. Special Function Config
   Special Function Off/On - OFF
   Function Type - Summed Flow
   External Input Max - 00 lb/hr

6. K -Factor Config
   K-Factor Off/On - ON
   Calc K-Factor ? - NO
   Number of Data Points - One Pair
   Measured Point Selection - 1000 lb/hr
   Reference Point Selection - 1000 lb/hr
   K-Factor Gain - SW = 1.737, NE = 1.318, NW = 1.276, SE = 1.515
   K-Factor Bias - 0.0%

7. Enhanced Display Config
   - Line 1 - Filter 3
   - Line 2 - Parameter Temp
   - Line 3 - Parameter Abs Pres
   - Line 4 - Parameter Diff Press
   - Diff Pressure Units= in. Wc

8. Analog Output Config
   - Output 4 Selec - Transmitter DP

9. Transducer Span Selection -
   - Xdcr Natural Span - 0.5 in.WC, sw = .3362, NE, NW = 0.319
   - Xdcr Operating Span - SOUTH=0.3753, NORTH=0.3191 in WC for 387,000 lbm/hr
   - (Calc from Mass Flow spreadsheet, set at highest temp and lowest pressure)

10. Transmitter Input Calib
    - Transducer Zero Calib - 0.00 in.WC
    - Transducer Span Calib - 0.5 in WC

11. Transmitter Ouput Calib
    - Output 1 Zero - Perform Calib
    - 1 Span - Perform Calib
    - 2 Zero - Perform Calib
    - 2 Span - Perform Calib
    - 3 Zero - Perform Calib
    - 3 Span - Perform Calib
    - 4 Zero - Perform Calib
    - 4 Span - Perform Calib

12. Xducr Characterization - depends on Xducer calib, values for U2.

SW	SE	NE	NW

DataPoint1

-

2721

Data Point 2	-	2,769	2,500	2,490	25010
Data Point 3	-	5,258	5.010	4,980	5010
Data Point 4	-	7,745	7,510	7,480	7,510
Data Point 5	-	10,238	10,050	9,990	10020

Note, these values are U1.

		Xducr Characterization					Xducr Characterization			
SW			Data 1	39		SE			Data 1	17
U1 SN	B26713		Data 2	2,512		U1 SN	B26712		Data 2	2,492
			Data 3	4,981					Data 3	4,976
			Data 4	7,441					Data 4	7,474
			Data 5	9,913					Data 5	9,990
NE			Data 1	23		NW			Data 1	23
U1 SN	B26711		Data 2	2,525		U1 SN	B26714		Data 2	2,502
			Data 3	5,040					Data 3	4,977
			Data 4	7,561					Data 4	7,488
			Data 5	10,103					Data 5	9,927

13. Display Internal Temp - 87° F - measurement exit

From: Jerry Finlinson
To: Howard Scott; Mark Panhorst
CC: Aaron Nissen; Bill Morgan; Garry Christensen; James Burr; Jerry Finl...
Date: 10/29/2010 12:58 PM
Subject: Overfired Air Flow pitot inspection

I completed an inspection of the Unit 2 overfired air flow pitots and purge air with James Burr on Tuesday, 26 Oct 2010. The pitots are all in good condition and the pitot holes are clear.

There were significant leaks in the purge air supply and solenoid valves.

SW
Leaks in the purge air filter and union.
Big leak in the top of SV-2 inside cab.
There was a pile of flyash in the corner of the duct, which would make the reading about 3% too high.

SE
Internal leak on the left side of PI-2
Leak behind the gauge of PI-2
Supply flange
Flyash pile inside duct, reading about 3% high.

NW
Big leak on top of SV-2

NE
Big leak on top of SV-2
Leak between inlet air filters, and left side of filters.
Minimal fly ash inside.

An I&C tech should be able to fix all the leaks by tightening fittings and replacing or repairing the SV-2's. Let me know if you have questions.

Thanks, Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
Delta, UT 84624
435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.

From: "Matt Maragos" <mmaragos@airmonitor.com>
To: "'Jerry Finlinson'" <Jerry-F@ipsc.com>
CC: "'Ken Hall <Ken Hall'" <khpquip@earthlink.net>, "'Mark Panhorst'" <MARK-...
Date: 11/5/2010 11:22 AM
Subject: RE: Overfire air CAMSpanels SV-2 leakage from upper hole

Jerry,

Heat could be a contributor, how hot does it get up on the OFA? These shipped in '03 (similar time frame as the PA). Seven years installed, I don't think heat is a dominating issue, but maybe it is just enough (e.g., *intermittent summer temps for a couple months a year) affecting long term* performance.

It would be a good idea to put a temp logger on at least one of the panels to see what the internal temps are getting to. If necessary, we have a thermostatically controlled Venturi cooler kit that tees into the AUTO-purge compressed air supply. It would keep the enclosure temps down.

How about the other OFA units? There were eight (four per Unit?) according to our records.

Do you want to get pricing on a replacement valve? With the replacement in, you could ship a failed unit back to AMC for inspection? We can determine if it is repairable.

Thanks.

Matt

-----Original Message-----
From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, November 04, 2010 5:28 PM
To: Matt Maragos
Cc: 'Ken Hall <Ken Hall'; Mark Panhorst
Subject: RE: Overfire air CAMSpanels SV-2 leakage from upper hole

Mark,

I did go by and check the Primary Air CAMS and none of them were leaking, so I guess we got a

bad batch on the OFA. It is a bit hotter up there. All 4 of them are leaking.

Jerry

Jerry Finlinson, Control Engineer
Intermountain Power Service Corp
850 West Brush Wellman Rd
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435-864-6466 FAX 0776

jerry-f@ipsc.com
There's always more to do than you can do.>>> "Matt Maragos" <mmaragos@airmonitor.com> 11/4/2010 4:10 PM >>>

Jerry,

It is not normal. I can't tell exactly what part has failed. There is an o-ring, but also some other seals that are integral to the solenoid shaft (those are not in our rebuild kit) and if one of these failed, it may require replacement of the entire valve - I will check on that. I wouldn't expect that it would create an AUTO-purge functionality problem, other than leaking compressed air.

I suggest purchasing a complete spare, swapping the new valve in, then returning the replaced leaking valve to us. We can disassemble and figure out what has failed, then we can also determine what parts are necessary to repair (if possible). If parts can be replaced on the valve to fix it, then we can provide you with those parts / tools and a procedure to repair any others onsite. I think there is a simple tool to unscrew the solenoid shaft from the valve body too. Likewise, if repair is possible, we can do the work here.

Please let me know what will work best for you and I can get you a quote.

Thanks.

Matt

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From: Jerry Finlinson [mailto:Jerry-F@ipsc.com]
Sent: Thursday, November 04, 2010 1:21 PM
To: Matt Maragos
Cc: "Ken Hall" <Ken Hall; Mark Panhorst
Subject: Overfire air CAMSpanels SV-2 leakage from upper hole

Matt,

I have a question about the overfire air CAMS panels

We were snoop checking our panels for air leaks and find that they have a continuous air bleed from a small hole

in the top over of the SV-2 solenoid valve. Is this normal or is there possibly a leaky O ring inside the solenoid that

needs to be repaired? See attached photo. Please advise.

Thanks, Jerry

Jerry Finlinson, Control Engineer
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